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THE VALUE OF CÆCOSTOMY IN THE TREATMENT OF MALIGNANT DISEASE OF THE COLON.*

By Sir HAROLD STILES Edinburgh

Malignant disease of the colon is one which all of us encounter is part of the routine of our general surgical work In spite of the fact that the subject has been much discussed it seems to me that surgeons are by no means unanimous is to the best method of dealing with it In proof of this I need only mention the recent paper in the *Annals of Surgery* for February, 1920, by Mr Dowd, of New York, who is a strong advocate of the Mikulicz operation, and to a paper in the *Journal of the American Medical Association* for July 31, 1920, by Mr Bevan, of Chicago, who, like myself is equally convinced of the value of cæcostomy

Although the disease runs a chronic course, and the sign-posts which point to its presence are generally obvious enough, it is surprising, as well is somewhat deplorable to find that so many cases do not reach the surgeon until the symptoms have culminated in complete obstruction The symptoms ought to be sufficiently appreciated by the medical attendant to rouse his suspicion it any rate, and all he has to do is to call in the aid of a good radiographer who can not only settle the diagnosis but, what is equally important from the surgeon's point of view, can also demonstrate the position of the tumour And here I would like to emphasize the importance of giving a bismuth enema is well is a bismuth meal indeed, of the two, I am inclined to think the latter often gives us the more information

From the surgical point of view we have to consider, first the treatment when the disease has been diagnosed before complete obstruction has set in, and, secondly the treatment when this complication has arisen In order the better to develop my thesis let me deal with the latter first

Most of us are old enough to remember the day when it was the custom to open the abdomen and, having searched for and found the obstruction to proceed it once to remove it and to re-establish the continuity of the canal It is unnecessary to dwell upon the tragic results which followed such a procedure we are all only too painfully conscious of them and would gladly blot them from our memories We are now all agreed that the right thing to do is to be contented with relieving the obstruction in the first instance and, when possible to remove the disease it a subsequent operation Suppose that our patient with complete obstruction is enfeebled from age or is in other respects a bad subject for operation I think we are equally agreed that it is our duty to relieve the obstruction in the simplest possible way and with a minimum of risk to the patient

The history along with the absence of a tumour in the rectum enables us to say almost with certainty that the obstruction is situated somewhere in the large intestine above that organ in which case all that is necessary is to make a small incision in the right iliac region to bring out a small diverticulum of the cæcum and to suture its base very carefully to the peritoneum and the deeper muscles If the relief of the obstruction has become urgent the bowel may be drained forthwith by the introduction of a small Paul's tube I say a *small* tube advisedly because the contents of the cæcum are more or less fluid and will therefore drain through a small tube moreover by using a small

one the resulting fistula will generally close spontaneously after the obstruction has been removed   If necessary, the operation can easily be done under local anæsthesia

In doing this simple operation, experience has taught me that on no account should the whole cæcum be pulled out of the wound   If this is done there is a grave risk that as soon as the bowel is deprived of the support of the abdominal wall it will at once become so distended and ballooned that its peritoneum is almost certain to split, and there is even a danger of rupture of all the coats

The next point we have to consider is whether, in the presence of complete obstruction, the hand should be introduced into the abdomen in search of the exact situation of the tumour before proceeding to do the cæcostomy   In my opinion this is unnecessary, as the site of obstruction can be ascertained by radiography after the patient has been tided over the obstruction   If, however, the obstruction be of the *subacute* variety, and the patient s general condition is otherwise satisfactory, the surgeon may feel justified in introducing his hand into the abdomen before proceeding with the cæcostomy   In the event of his deciding to do so, he may either enlarge the iliac wound sufficiently for the purpose, or may make a separate medial (or paramedial) incision   On the whole I am in favour of the latter   firstly, because it gives better access to the whole abdomen, and secondly, because the wound can easily be protected from contamination from the cæcostomy opening, whereas we have no certain means of preventing infection of the wound in the iliac region

It is wonderful how rapidly the patient recovers from the effects of the obstruction after the cæcum has been opened , by getting rid of the stasis in the small bowel the patient s general health improves so much that the major operation may be done ten days or so after the cæcostomy

It is unnecessary for me to enter into any details regarding the enterectomy, but what I would like to emphasize is how much I have been impressed by the smooth and uneventful *convalescence which even old people have made who have undergone a secondary enterectomy after a primary cæcostomy for complete obstruction ,* indeed in many cases, on account of the absence of all flatulence, they have complained less than patients often do who have undergone a simple appendectomy during a quiescent period   The cæcostomy opening has acted as a safeguard against gas pressure

But this is by no means the only advantage of the preliminary cæcostomy   By preventing distention from flatulence, it not only prevents pain and discomfort, it also gives rest to the bowel , it takes the strain off the intestinal sutures, and almost eliminates the risk of a localized abscess and fæcal fistula developing about a week or ten days after operation, a complication due to a slight leakage or necrosis at the suture line

Now let us consider the methods which may be adopted in the absence of obstruction

In the simple cases, the surgeon may decide to complete the operation in one stage by resecting a portion of the bowel and restoring continuity either by an end-to end or a lateral anastomosis   The only complication which is likely to interrupt the patient s convalescence seriously is the one I have just referred to   It is with the object of avoiding this complication that most surgeons, I think, prefer to do a lateral anastomosis rather than a direct end-to end union   Now experience has shown that this complication almost never happens after resection of the *proximal* third of the *large bowel, the explanation* no doubt being that the contents of this part of the intestine are more or less fluid and therefore readily pass through the seat of anastomosis   In the *more distal portion of the large bowel, on the other hand, the fæces are more solid, and when the lumen has been markedly strictured by the tumour it often happens that the castor oil which has been given preparatory to the operation has failed to empty the bowel, and that too much* strain is put on the sutured bowel, partly by the solid fæces and, perhaps to a still greater extent by the distention caused by the accumulated flatus

It is to get over this difficulty that many surgeons, even in the absence of obstruction, prefer to employ the two stage operation which is associated with the names of Paul and Mikulicz   Although this may be a safer method, it is certainly a more trying ordeal for the patient   Moreover, the closure of the bowel after the spur has been got rid of is

not always such a simple matter as it sounds, and not infrequently a second operation is called for before it is finally effected   The result is that many weeks may elapse before the patient is out of the surgeon's hands

In dealing with malignant disease between the hepatic flexure and the pelvirectal junction, the question we have to consider, therefore, is whether it is possible to find a compromise between the two procedures above referred to—a method, that is to say, which combines the advantages of both without possessing the disadvantages and risks of either

The experience I have had in dealing with the cases which have been operated on when the obstruction has become complete has convinced me that there is such a method, and that the risks which attend the one-stage operation may be largely, if not entirely, eliminated by opening the cæcum   I have entirely given up the Mikulicz operation   For the past ten years it has been my invariable practice, in the absence of obstruction to do a primary resection followed by an end-to-end anastomosis , and then, as the final step of the operation, to make a small incision over the cæcum and by means of a carefully applied continuous suture, to stitch the circumference of an area of the anterior wall of the cæcum about the size of a two-shilling piece to the parietal peritoneum and the two deeper muscles   The cæcum is opened twenty-four or forty-eight hours later   A tube about the diameter of a lead pencil is introduced to keep the opening patent   The opening, by providing for the escape of flatus, acts as an efficient safety-valve in preventing all strain on the intestinal sutures   As already mentioned, the patient has almost always a painless and uneventful convalescence , moreover, there is no hurry or anxiety about the giving of an aperient to get the bowels to move   Quite frequently there is a movement by the rectum without the help of an aperient , if one should be necessary it need not be given until the end of the first week by which time the healing of the bowel will have become secure

The opening in the cæcum need only be about three-quarters of an inch in length, and as it is not intended to be permanent its edges should not be sutured to the skin   In the majority of cases the fistula will have closed spontaneously either when, or shortly after, it is time for the patient to leave the hospital, which he usually does in about three weeks from the date of operation   From the patient s point of view, therefore, this procedure possesses a great advantage over the Mikulicz operation

To prevent fæcal matter from the cæcostomy opening reaching the main wound, all that is necessary is to cover over the gauze dressing with a sheet of batiste and fix to the skin (with Michel's clips) the edge which is directed towards the cæcostomy opening

In my opinion there are three advantages which may be claimed for combining a small cæcostomy opening with a primary resection   They are —

1 It allows of an end-to-end union with safety

2 This, again, makes it easier to remove a greater extent of bowel, mesentery, and glands than if it were intended to re-establish continuity by a lateral anastomosis

3 It is sometimes possible to effect an end-to-end union in cases in which a lateral anastomosis would be impracticable , for example, when the tumour is situated rather near the pelvirectal junction

I have become so convinced of the great value of cæcostomy in the treatment of malignant disease of the large intestine that I have seriously considered the question as to whether it is advisable to do it as a preliminary to a resection at a later date, even in the absence of obstruction, just as we do a sigmoidotomy preliminary to removal of the rectum   It is true that in the latter case we divert the whole of the fæces from the pelvic wound, whereas by the cæcostomy we only divert a part of them , it is enough, however to provide a safety-valve   I will at any rate go so far as to advise a preliminary cæcostomy in patients who, while not suffering from complete obstruction, are to be regarded as bad operative risks, because after the cæcostomy they may pick up sufficiently to warrant the risk of the major operation

Lastly, let me take the opportunity to mention the value also of cæcostomy in the treatment of megalocolon, of volvulus of the sigmoid, and of certain cases of diverticulitis   Here, again, the cæcostomy may be done either as a preliminary to the major operation, or as a part of it, according as the merits of the case demand

EPONYMS *

By Sir D'ARCY POWER K B F London

It is proposed to give in the following series of articles the *ipsissima verba* of those surgeons whose names are associated with the diseases or injuries to which they first called attention Many of these descriptions are so short that they can be reproduced at length others will be abbreviated , but all are so clear that they have gained a world-wide acceptance Most medical students and many of their teachers are posed when they are asked Why is the injury called 'Colles s fracture '? Where is Brodie's abscess described ? Why are 'Baker s cysts' so called ? Was it the same surgeon to whom 'Pott's fracture', 'Pott s puffy swelling , and 'Pott s disease of the spine are assigned ? Where and when did Paget write about 'osteitis deformans' and his 'disease of the breast' ? To those who know where to look for them the original papers are not hard to find, but as few have the inclination or the leisure to discover them this series of short articles may prove both instructive and interesting

I COLLES'S FRACTURE

The Edinburgh Medical and Surgical Journal, 1814 Vol X, page 182, contains an article " On the Fracture of the Carpal Extremity of the Radius', by A Colles, M D , one of the Professors of Anatomy and Surgery in the Royal College of Surgeons in Ireland , of which the following is a complete transcript —

" The injury to which I wish to direct the attention of surgeons, his not, as far as I know, been described by any author , indeed, the form of the carpal extremity of the radius would rather incline us to question its being liable to fracture The absence of crepitus and of the other common symptoms of fracture, together with the swelling which instantly arises in this, as in other injuries of the wrist, render the difficulty of ascertaining the real nature of the case very considerable

" This fracture takes place at about an inch and a half above the carpal extremity of the radius, and exhibits the following appearances

" The posterior surface of the limb presents a considerable deformity , for a depression is seen in the forearm, about an inch and a half above the end of this bone while a considerable swelling occupies the wrist and metacarpus Indeed, the carpus and base of metacarpus appear to be thrown backward so much as on first view to excite a suspicion that the carpus has been dislocated forward On viewing the anterior surface of the limb, we observe a considerable fulness as if caused by the flexor tendons being thrown forwards This fulness extends upwards to about one third of the length of the forearm, and terminates below at the upper edge of the annular ligament of the wrist The extremity of the ulna is seen projecting towards the palm and inner edge of the limb , the degree, however, in which this projection takes place, is different in different instances

' If the surgeon proceed to investigate the nature of this injury he will find that the end of the ulna admits of being readily moved backwards and forwards

" On the posterior surface, he will discover by the touch that the swelling on the wrist, and metacarpus, is not caused entirely by an effusion among the softer parts , he will perceive that the ends of the metacarpal, and second row of carpal bones, form no small

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part of it This strengthening the suspicion which the first view of the case had excited leads him to examine in a more particular manner, the anterior part of the joint, but the want of that solid resistance which a dislocation of the carpus forward must occassion (*sic*), forces him to abandon this notion and leaves him in a state of perplexing uncertainty as to the real nature of the injury He will, therefore endeavour to gain some information by examining the bones of the fore arm The facility with which, (as was before noticed,) the ulna can be moved backward and forward, does not furnish him with any useful hint When he moves his fingers along the anterior surface of the radius, he finds it more full and prominent than is natural a similar examination of the posterior surface of this bone, induces him to think that a depression is felt about an inch and a half above its carpal extremity He now expects to find satisfactory proofs of a fracture of the radius at this spot For this purpose, he attempts to move the broken pieces of bone in opposite direc tions but although the patient is by this examination subjected to considerable pain, yet neither crepitus nor a yielding of the bone at the seat of fracture, nor any other positive evidence of the existence of such an injury, is thereby obtained The patient complains of severe pain as often as an attempt is made to give the limb the motions of pronation and supination

' If the surgeon lock his hand in that of the patient's, and make extension, even with a moderate force, he restores the limb to its natural form, but the distortion of the limb instantly returns on the extension being removed Should the facility with which a moderate extension restores the limb to its form, induce the practitioner to treat this as a case of sprain he will find, after a lapse of time sufficient for the removal of similar swellings, the deformity undiminished Or, should he mistake the case for a dislocation of the wrist and attempt to return the parts *in situ* by tight bandages and splints, the pain caused by the pressure on the back of the wrist will force him to unbind them in a few hours and, if they be applied more loosely, he will find, at the expiration of a few weeks, that the deformity still exists in its fullest extent, and that it is now no longer to be removed by making extension of the limb By such mistakes the patient is doomed to endure for many months considerable lameness and stiffness of the limb, accompanied by severe pains on attempting to bend the hand and fingers One consolation only remains, that the limb will at some remote period again enjoy perfect freedom in all its motions and be completely exempt from pain, the deformity, however, will remain undiminished through life

" The unfavourable result of some of the first cases of this description which came under my care forced me to investigate with peculiar anxiety the nature of the injury But while the absence of crepitus and of the other usual symptoms of fracture rendered the diagnosis extremely difficult, a recollection of the superior strength and thickness of this part of the radius, joined to the mobility of its articulation with the carpus and ulna, rather inclined me to question the possibility of a fracture taking place at this part of the bone At last, after many unsuccessful trials, I hit upon the following simple method of examination, by which I was enabled to ascertain, that the symptoms above enumerated actually arose from a fracture seated about an inch and a half above the carpal extremity of the radius

" Let the surgeon apply the fingers of one hand to the seat of the suspected fracture, and, locking the other hand in that of the patient, make a moderate extension until he observes the limb restored to its natural form As soon as this is effected, let him move the patient's hand backward and forward, and he will, at every such attempt, be sensible of a yielding of the fractured ends of the bone, and this to such a degree as must remove all doubt from his mind

" The nature of this injury once ascertained, it will be a very easy matter to explain the different phenomena attendant on it, and to point out a method of treatment which will prove completely successful The hard swelling which appears on the back of the hand, is caused by the carpal surface of the radius being directed slightly backwards instead of looking directly downwards The carpus and metacarpus, retaining their con- nections with this bone, must follow it in its derangements, and cause the convexity above

alluded to   This change of direction in the articulating surface of the radius is caused by the tendons of the extensor muscles of the thumb, which pass along the posterior surface of the radius in sheaths firmly connected with the inferior extremity of this bone The broken extremity of the radius being thus drawn backwards, causes the ulna to appear prominent toward the palmar surface, while it is possibly thrown more towards the inner or ulnar side of the limb by the upper end of the fragment of the radius pressing against it in that direction   The separation of these two bones from each other is facilitated by a previous rupture of their capsular ligament, in event which may readily be occasioned by the violence of the injury   An effusion into the sheaths of the flexor tendons will account for that swelling which occupies the limb anteriorly

   " It is obvious that, in the treatment of this fracture, our attention should be principally directed to guard against the carpal end of the radius being drawn backwards For this purpose, while assistants hold the limb in a middle state between pronation and supination, let a thick and firm compress be applied transversely on the anterior surface of the limb at the seat of fracture, taking care that it shall not press on the ulna , let this be bound on firmly with a roller, and then let a tin splint, formed to the shape of the arm, be applied to both its anterior and posterior surfaces   In cases where the end of the ulna has appeared much displaced, I have laid a very narrow wooden splint along the naked side of this bone   This latter splint, I now think, should be used in every instance, as, by pressing the extremity of the ulna against the side of the radius, it will tend to oppose the displacement of the fractured end of this bone   It is scarcely necessary to observe, that the two principal splints should be much more narrow at the wrist than those in general use, and should also extend to the roots of the fingers, spreading out so as to give a firm support to the hand   The cases treated on this plan have all recovered without the smallest defect or deformity of the limb, in the ordinary time for the cure of fractures

   " I cannot conclude these observations without remarking, that were my opinion to be drawn from these cases only which have occurred to me, I should consider this as by far the most common injury to which the wrist or carpal extremities of the radius and ulna are exposed   During the last three years I have not met with a single instance of Dessault s dislocation of the inferior end of the radius, while I have had opportunities of seeing a vast number of the fracture of the lower end of this bone

   "*Stephens Green, February* 21 1814 '

   Thus, with 1528 words and at the age of 41, Colles secured for himself a permanent name in surgery   It may be observed that his account is strictly clinical, for he had no opportunity of making a pathological examination of the injury

   In 1837 Colles dedicated his *Practical Observations on the Venereal Disease* to Sir Astley Cooper   In an interesting chapter on " Syphilis in Infants ', he says (p 285) ' It is a curious fact that I have never witnessed nor ever heard of an instance in which a child deriving the infection of syphilis from its parents has caused an ulceration in the breast of its mother '   This statement, which was found to be true, afterwards passed current as 'Colles s law ', though it is sometimes called Baumes law , as Baumes noted the same fact in 1840, three years after Colles had enunciated it   It was not until 1865 that Guiseppe Profeta pointed out that " a healthy child born of a syphilitic mother can be suckled by her or by a syphilitic wet nurse with impunity   which is Profeta s law

FRACTURES OF THE CARPAL SCAPHOID

By ALAN H TODD, London

The great majority of the cases of fracture of the carpal scaphoid that present themselves in the wards or the out-patient department of Guy s Hospital are examples of old fracture and the reason for attending is invariably the same, viz, that the wrist is not is good as it was or is it should be, and that it interferes materially with the wage-earning capacity either because it hurts, or is weak, or for both reasons On inquiring into the history, it generally transpires that the case was not diagnosed as one of fracture at the time of the initial injury usually it was regarded and treated as one of 'sprain In other words, it is only when serious sequelæ have arisen and failed to disappear even after some months or years of symptomatic treatment, that a correct diagnosis is generally made and the acute fracture, as such, is very often missed In the special Fracture Out-patient Department (where all ambulatory fractures are treated), such cases are comparatively rare only 9 have been found there, in a consecutive series of 3000 cases of one sort and another In this particular department, all cases of injury of the wrist of whatsoever kind, are examined with the x rays as a routine procedure and a plate is always taken the wrist is examined anteroposteriorly and laterally, and sometimes obliquely as well, so that it is improbable that many cases of fracture of the scaphoid are overlooked Moreover, since the writer s attention was first directed particularly to this class of case, the radiograms of all the Colles's fractures and other injuries in the neighbourhood of the wrist have been re-examined, and no example of fracture of the scaphoid has been discovered amongst them

In the general surgical clinics, cases of recent fracture of the carpal scaphoid are practically never seen it appears, therefore, to be justifiable to conclude that (1) A number of recent cases of this fracture are overlooked, and either do not come to hospital at all, or else are to be sought for in the minor-casualty departments, being treated for 'sprain or the like , (2) When all cases of injury in the region of the wrist are x-rayed as a routine, with a good technique, fracture of the carpal scaphoid can always be detected In other words, given a due appreciation of the likelihood of such an injury being present, and given also an opportunity for radiographic examination, there is no excuse for cases being wrongly diagnosed

Without in any way condoning carelessness in the diagnosis of fractures in general, one must admit that there are cases in which failure to detect that a fracture is present does not materially damage the patient, in so far as his ultimate functional result is concerned In many cases of incomplete fracture, for example (such as were invariably overlooked until the advent of x rays), a layman would probably be quite willing to use his limb as long as he regarded it as being merely sprained, and probably he would get a very good result in consequence If, however, he knew that it had been fractured, he would regard the injury as being much more serious , even if it were only a fracture in the most technical sense of the phrase, he would be inclined to avoid using his limb, to anticipate pain and disability, and so on, and the ultimate result might very well be impaired in consequence The public does not discriminate, as a rule, between various types and degrees of fracture , for them, a fracture is a fracture, and a very serious thing too This pessimistic belief is unfortunately not altogether unjustified, for after all it is the conclusion that the public has arrived at in the light of bitter experience , they judge by results, by what they themselves have seen and experienced, and no one could deny that the results of fracture treatment in the past have often left much to be desired

The factor of suggestion and autosuggestion is also a huge one in determining the functional result after fracture   It is not many years since the medical profession generally was accustomed to encase the limb in rigid splints for a very long time after a fracture, and to enjoin perfect rest and various irksome restrictions, the whole atmosphere of the patient seemed almost to be designed so as to magnify the gravity of the injury   Even when the splints were taken off, there was a long period of after-treatment to be faced, wasted muscles to be exercised, stiff joints to be moved, and adhesions to be painfully broken down   The ultimate result was not always good, and patients were told (and learned for themselves) that they must expect pain if they wanted to get a good result, or, perhaps, that they must expect always to have some physical disability   It is hardly to be wondered at, then, if the public look upon fractures rather pessimistically at the present time   their view-point to-day is the outcome of the way in which they were treated, and the things they were told, yesterday, tradition changes slowly   We have taught them to regard a fracture as being a very serious thing, usually associated with pain and disablement, therefore they expect them, and even if they are not always present they imagine them   That is to say, traumatic hysteria is very common after fractures, but it is quite preventable partly by our doing much better work in the future than we did in the past, and partly by our educating the public up to quite a different conception of fractures

But in the case of fractures of the carpal scaphoid there is no question of hysteria, or of any other form of suggestion or autosuggestion, if a case is not properly diagnosed and treated, there will be serious disability, almost to a certainty, and probably it will be permanent   Medical writers are not given to recording their failures, yet the literature of fractured scaphoid teems with accounts of operations performed in the hope of mitigating the disability that has ensued on a 'missed' fracture   And these operations have not been very successful on the whole, for though many authors have claimed good results in individual cases, or in very small series of cases, yet a large number of different procedures have been described—a sure proof that no one method has shown itself to be really good   The majority of surgeons are very pessimistic concerning the prognosis in cases of old fracture of the scaphoid, with or without operation and it would be difficult to find anyone who would guarantee to make a man's wrist normal again by operation after such a fracture

In all the cases of old fracture that the writer has seen, the complaint has been the same, viz, that the condition of the wrist was such that it interfered materially with the man's wage-earning capacity   Either it was painful, or it was weak, or it was liable to catch or to give way just as the patient was performing some muscular action, sometimes swelling was complained of, but generally it has been mechanical weakness or unreliability   All the Guy's cases have occurred in men of early adult age, most of them have been mechanics   In this small series, as in all published cases, the majority of the fractures have occurred in the right hand   In every case, a definite history of the causal injury could be obtained without difficulty, the man could say just when it happened, and what he was doing at the time, he was always quite clear as to the precise moment at which the damage was done, and there was no question of his merely presuming that an injury must have taken place, when he came to think the matter over in the light of subsequent experience   On the other hand, it was not always possible to ascertain the exact mechanism of the fracture, the patient having very often forgotten the precise position of the hand and wrist at the time   The most common account is that the man fell on to the outstretched palm, the wrist, of course, being hyperextended   Occasionally, the hyperextension is the result of a motor-engine back firing, and not of a fall   At any rate, in those cases in which the fracture has resulted from overextension of the wrist, there has always been a considerable amount of force exerted, fracture of the carpal scaphoid is never the result of a mild injury   The violence necessary to break the bone is such that it is very unlikely to be forgotten, this is a point of much importance in connection with the much-debated question of bipartite scaphoid versus fracture (vide infra)   In yet other cases a different kind of mechanism altogether seems to have come

into play, in certain instances, for example, the bone has apparently been broken with the wrist hyperflexed, and certain writers regard this as the normal mechanism of fracture, in the present series however, hyperextension together with the exercise of considerable violence appears to have been the usual mechanism

The first step, then, towards the diagnosis of fracture of the carpal scaphoid consists in eliciting the history of the causal injury, which is very definite and characteristic

The next point is to make out what the results of this injury were These also are very definite, and appear to the writer to be both striking and characteristic The first sign, as a rule is swelling, it appears almost at once and is most marked in the region known as the 'anatomical snuff-box' it is never great, and it is never very widespread the tendons which form the boundaries of the snuff-box may be obscured, and the œdema may sometimes spread a little way upwards tending rather to follow the line of the lower end of the radius but it never surrounds the whole wrist and it seldom even extends right across the back of it Very seldom indeed does it travel down the back of the hand towards the base of the index finger The folds at the wrist are never obliterated In

short, the swelling takes the form of a rapid localized œdema on the dorsum of the radial half of the wrist-joint (Fig 1) In true sprain of the wrist (by which should be meant traumatic synovitis of the wrist-joint, and no other condition), the swelling is much greater in amount, and much more diffuse But the chief point to emphasize in connection with 'sprained wrist is that it is an excessively rare condition—so rare, in fact, that many surgeons who have great experience of fractures doubt its very existence As Speese[64] well says, ' Sprain of the wrist is a diagnosis which is less and less tenable If only this fact were as fully appreciated as it should be, a very large number of fractures of various kinds (not to mention other important injuries, such as dislocations of various carpal bones, especially the semilunar) would be discovered, and much prolongation of disability and depreciation

Fig 1 The typical œdema of a case of fractured scaphoid

of earning capacity would be avoided in consequence It is extraordinary that the diagnosis of sprained wrist is so commonly made, when as a matter of fact the injury so rarely occurs In tenosynovitis, such as sometimes follows a violent wrench of the wrist, there is swelling, but this is usually all about the extensor tendons, and extends right across the back of the wrist, whilst the snuff-box is not particularly swollen Moreover, the typical soft crepitation that characterizes tenosynovitis is always very easily perceptible when the examiner's fingers are placed flat upon the back of the wrist and the joint is then moved to and fro

In the early stages the swelling is ordinary soft œdema , if the case is recognized as one of fracture of the scaphoid, and is skilfully treated, it will probably disappear But if it is overlooked or neglected, some part of the swelling will almost certainly persist for years afterwards , in any case of 'missed' fracture, it is always possible to detect some fullness in the snuff-box, whilst the tendons defining that space are a little less obvious than they are on the uninjured side At this late stage the swelling is not purely œdema, of course , some of it is due to actual organic thickening , but a part is still caused by œdema, set up, presumably, by the effect of moving the arthritic joint At operation it

is usually quite easy to demonstrate these two elements that go to make up the chronic swelling viz , the œdema and the organized inflammatory material

Ecchymosis is extremely rare in fractures of the scaphoid, because rupture of the capsule of the wrist-joint is very rare in these cases, whereas in severe contusion of the tissues about the joint ecchymosis is both common and widespread

So much for what may be seen by a mere inspection of the wrist at rest   We come now to palpation   A careful observer will make his diagnosis practically without having to move the wrist at all , it any rate it need only be moved a very little, and it is never necessary to put the patient to any severe pain in order to ascertain that a fracture of the scaphoid has occurred, no matter whether the case be a recent or a late one   The first point that will be ascertained is that there is acute local tenderness , this is situated just beyond the radial styloid process, in the anatomical snuff-box , it is, in fact just over the proximal fragment of the scaphoid   Special care should be taken in defining the exact site of the tenderness, for it is an important point in the differential diagnosis , for instance,

FIG 2 —Showing the transmission directly to the scaphoid of the force of a blow applied to head of second metacarpal

in fracture of the radial styloid process itself, the tenderness is a little higher up, and more on the outer border of the limb, whilst in Colles s fracture the line of tenderness is again over the exact site of fracture, i e , some ¾ in above the lower articular surface of the radius   In fact, as J B Murphy[1] puts it, " the first stage of the diagnosis is the appreciation of the fact that the injury is substyloid '   The mere fact, however, that a person is tender in the snuff-box, and that such tenderness is limited to the region of the snuff-box, is not enough to warrant a diagnosis of fracture of the scaphoid   In recent cases, of course, there will be the œdema, and the pain and the impairment of function, to make the diagnosis clear , but in old cases there may be a possibility of mistake   Every one is tender, to some extent, in the proximal half of the anatomical snuff box, because that is just where the dorsal branch of the radial nerve runs, and firm pressure there is capable of injuring it   But it is quite easy to distinguish radial nerve pain from frac tured-scaphoid pain, because the nerve pain is not nearly so acute as the pain that is associated with fracture (even old fracture), and it becomes less after a few moments during which the pressure is maintained, because pres sure anesthesia supervenes , in the case of fracture, however, the pain becomes unbearable   Moreover, the nerve-tenderness can be elicited in either wrist by an equal amount of pressure, whereas the fracture-tenderness is presumably unilateral as a rule   In recent cases the tenderness of the fracture is considerable , one author describes it as a 'wincing' tenderness, and this is a very good description, which gives a very accurate and graphic impression of what one sees in such cases

Another valuable method of eliciting the tenderness is by means of the application of force at a distance, i e , the indirect jarring of the site of fracture   This is the principle involved in Vaughan's knuckle percussion test   The metacarpophalangeal joints are all flexed to a right angle, or, if possible, the patient is made to clench his fist , he is then told to keep his eyes shut whilst the surgeon taps the knuckles smartly, one after another, with an ordinary rubber-headed knee jerk hammer   If fracture of the scaphoid is present, sharp pain will be elicited when the head of the second metacarpal is struck, but not when any of the others is struck , Fig 2 shows quite clearly that the force of a blow upon the end of the second metacarpal would be transmitted directly along the bone to the trapezoid and scaphoid, whereas a blow on any of the others would be dissipated before it could

reach the scaphoid Incidentally, it may be pointed out that it would be the third meta-carpal that would be tender in cases of fracture of the semilunar This point is sometimes helpful in the differential diagnosis either before a-ray examination or in places where an a-ray apparatus is not available Vaughan's test is very reliable when it is positive, but it is not invariably present in the first few days after a fracture it can generally be demonstrated without difficulty , but a week or more after the date of injury, some patients will allow the second metacarpal to be quite sensibly jarred without making any complaint

In the acute stage, the typical swelling, the severe pain that is made worse by every sort of movement, the acute tenderness just over the scaphoid distal to the radial styloid process, and the limitation of movement, especially of dorsiflexion of the wrist, make up a picture that is so absolutely characteristic that it is always possible to diagnose fracture of the scaphoid with perfect confidence it is incredible that anyone who is conversant with the physical signs of this fracture could ever miss a case The only possible explanation for the marked preponderance of missed cases over recent cases is that these signs are not familiar to the generality of practitioners In view of the very grave disability that ensues when a fracture of the scaphoid is overlooked, however, it is clearly of great importance that the attention of the rank and file of our profession should be drawn to this fracture, and to its diagnosis and treatment

Even in a late case the typical swelling is not always totally absent , some trace of it is often to be observed, in the form of a puffiness in the region of the snuff-box Tenderness, too, can sometimes be elicited , if the fragments of the scaphoid are completely ununited, or if the bone has united with excess of callus, there may be definite local tenderness on pressure directly over the bone Any attempt, moreover, to extend the wrist beyond its ordinary range will result in pain

Limitation of extension of the wrist-joint is present from the first If perfect gentleness is exercised in the clinical examination, it is usually possible to get a man with a fractured scaphoid to flex his wrist, but by no means can he be induced to extend the joint to more than 45° at the very most , nor should one persist in trying, for the mere fact that extension is markedly limited and painful tells us all that we need to know In late cases the limitation still persists , even after the lapse of some years any attempt to thrust the wrist forcibly back to the normal extent will cause pain It seems probable that this pain is mainly a referred pain, whilst the limitation of movement is chiefly caused by muscular spasm, for the pain and limitation are mostly observed in those cases in which there is an actual arthritis present, and the limitation disappears entirely under anæsthesia , if it were due to adhesions, this would not be the case In other words, even the late rigidity and limitation of movement (extension) are to be regarded as being largely protective mechanisms

To conclude the clinical examination of the patient, two minor points in the differential diagnosis may be noted firstly, that the measurements of the two limbs are exactly the same (which would not be the case in a typical Colles fracture, for example), and, secondly, that there is no muscular wasting at any stage

It is only since the advent of a rays that fractures of the carpal bones have been recognized at all In fact, there is practically no literature at all upon the subject prior to the year 1900 , Hamilton dismisses the subject with the remark that of course the carpus may be involved in severe crushes of the whole limb , whilst other large and authoritative works have nothing to say about the subject at all Stimson, in 1900, wrote that crepitation was the one cardinal sign, whereas as a matter of fact it never occurs

Radiography should, of course, be employed as a routine in the examination of every case of injury in the region of the wrist , by this means many obscure cases will be rendered perfectly clear, and a vague and unconvincing diagnosis will be converted into a precise and satisfactory one Practically every case of so called 'sprain' of the wrist will be found to be in reality something else, and one may justifiably paraphrase Punch's famous advice, and say, " To those about to diagnose sprained wrist,—Don't ' When damaged wrists are x-rayed as a routine, fractures of the carpus are not overlooked, for

with a proper technique they are quite easy to detect, it is because these cases are not always radiographed that mistakes occur, and that we meet with so many overlooked fractures As we observed in our opening paragraph, it is not in the special fracture departments of our hospitals that we meet with the 'missed' cases, but in the minor dressing rooms, casualty departments, and so on

We have said that fractures of the scaphoid are easy to detect, provided that a proper technique is employed As a corollary to this, one should hasten to add that without a proper technique it is very easy to overlook a fracture or to diagnose fracture where none
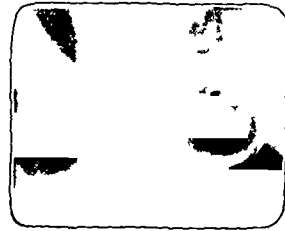
FIGS 3 & 4 —The shadow due to bad centration of x ray tube

exists In the first place, the shape of the scaphoid varies somewhat in different persons, according to their age, occupation, and so on But what is far more important is that very great variations in the apparent shape of the bone may result from variations in the position of the hand, or of the fluorescent tube as compared with the hand, at the time when the radiogram is being taken *Figs* 5 and 8 illustrate this point very clearly, whilst *Figs* 3 and 4 are two instances, picked at random out of a large number of x-ray pictures of the carpus, to show how imperfect centration may vitiate the shadow obtained It is evident from the most cursory examination of these radiograms that the best view of the bone is obtained when the hand is in the position of ulnar deflection, as in *Figs* 5 and 6, even when the hand is held normally in line with the forearm the scaphoid is very clearly seen, but here the foreshortened view of the tuberosity of the bone begins to be apparent, when the hand is in the position of radial deflection, as in *Fig* 8, the tuberosity stands out very clearly as a sort of second shadow superimposed upon the normal thickness of the bone Very often the outline of the tuberosity does not coincide accurately with that of the rest of the bone, and thus there is produced an appearance of a notch on the outer border of the bone, this is very frequently diagnosed by the uninitiated as a fracture, but by carefully scrutinizing the lower articular surface of the bone, i e, that for the os magnum, it will be seen that there is no evidence of fracture there (*Figs* 9 and 10) Occasionally the notch like border of the tuberosity has been described as evidence of a compression-

FIG 5 —Normal carpus in adduction, or ulnar deflection

fracture of the edge of the scaphoid produced by impaction upon the styloid process of the radius but this is simply a misinterpretation of radiographic appearances, such a fracture does not occur
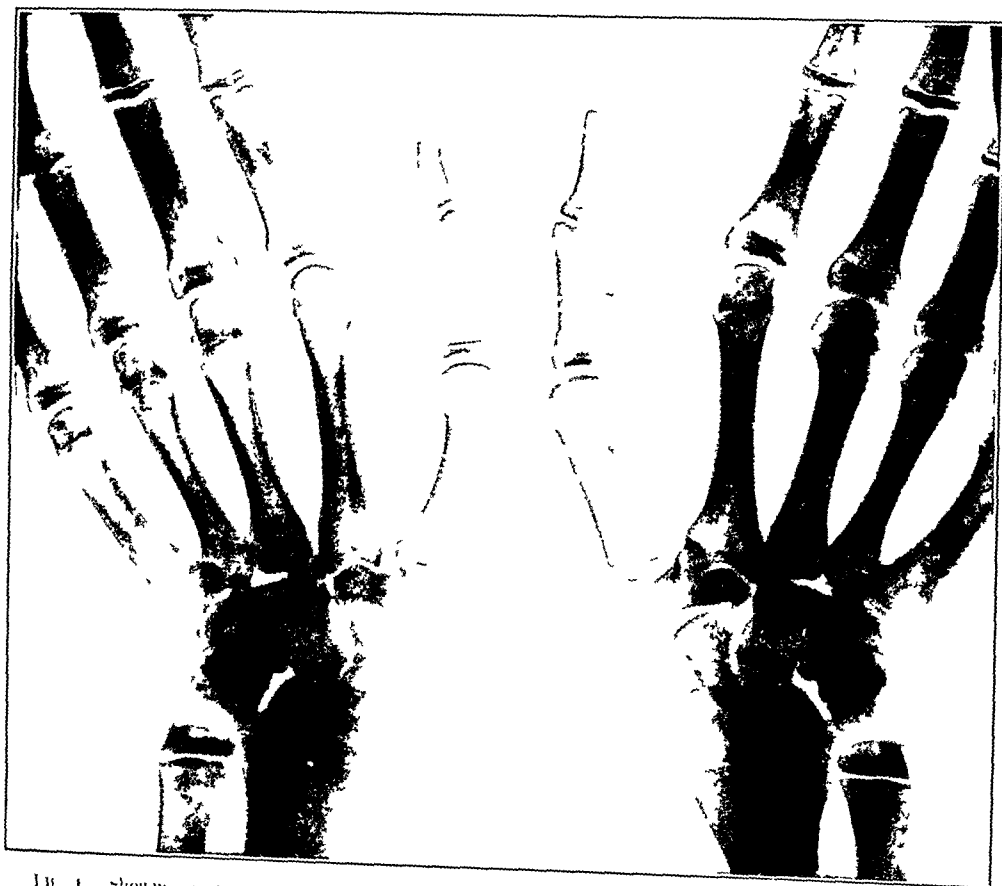
Fig 6 showing a simultaneous fracture of the right scaphoid and of the lower left radial epiphysis. He vertical crack through the latter is not well seen here but is quite distinct in *Fig* 7 taken from the same patient (Note how well the scaphoid is seen when photographed with the hand adducted)
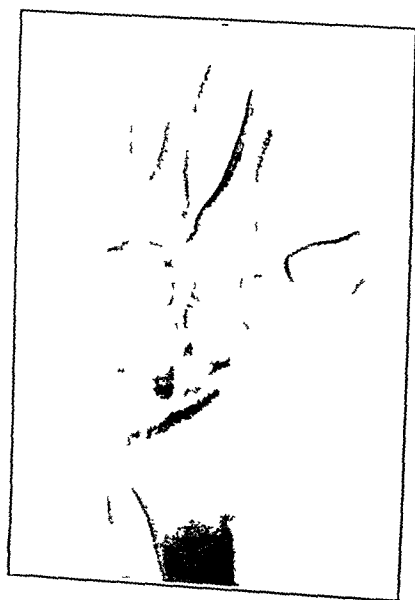
Fig 8 Normal carpus in adduction err in adduction

Codman and Chase,[11] in their classical article in the *Annals of Surgery* for 1905 lay down a precise technique to be adopted in x-raying cases of fractured scaphoid, or sus-pected cases of that injury, they say that the two hands should be placed side by side, palms downwards, and with the thumbs as close together as possible, the hands should be as much ulnar-deflected as possible, the tube placed on a level with the knuckles, and in this position the photograph should be taken (*Fig* 6) Further, views should be taken with the palms supina-ted   It is hardly necessary to add that plates should always be taken, mere examination with the fluoro-scopic screen is totally unreliable for the detection of these fractures in all cases   Nevertheless, in a doubtful case, screen-examination should be employed as an adjunct to the taking of plates, and for this reason the line of fracture, when the bone is broken through the waist, as it usually is, is not always just at right angles to the surface of the couch and to the incident ray, even when the hand is held in the standard position   The rays therefore have to travel through a normal thickness of bone, and the existence of a linear fracture may quite easily be overlooked in con-sequence   If, however, the wrist is slowly turned from the fully-supinated to the fully-pronated position, there must be, at some stage, a moment when the rays will pass through the small space between the fragments, and at this moment the observer will see a bright band of light on the screen   (This applies, of course, only to recent fractures, before callus-formation has taken place)   (*Figs* 11–13)

The proper routine to be observed, then, in x-raying a recent fracture of the scaphoid, consists in   (1) Fluoroscopy, in all positions between full supination and full pronation

FIG 9 — A notched scaphoid i e a view in which the fore-shortened tuberosity is superimpo ed upon the shadow of the remainder of the bone
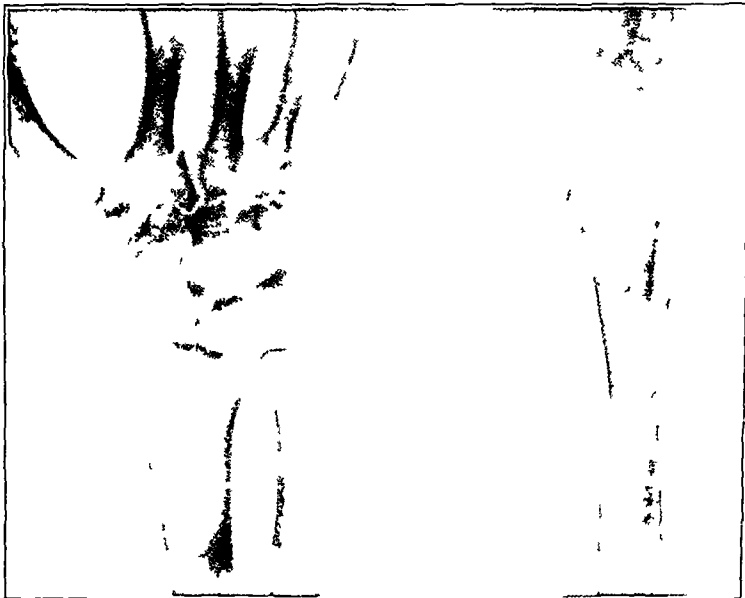
FIG 10 — Valle s fracture i e fracture of po terior l p of lower en l of radiu by force tran mitted throu h the scaphoid

(2) Taking plates of both wrists in Codman and Chase s standard position, one set with the palms turned up, and the other set with the palms turned down , (3) Occasionally, when the fracture of the scaphoid is merely part of a complicated injury of the carpus, it may be well to take stereoscopic pictures of the wrist , in such a view the bones stand out very perfectly in relief, and a very beautiful view of the carpal tunnel is secured
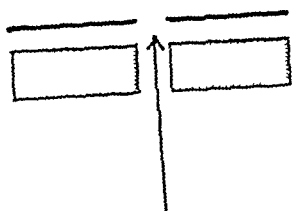
FIG 11 —Diagram showing how the x ray passing vertically through a fracture of the scaphoid produces a clear band of light across the shadow on the screen
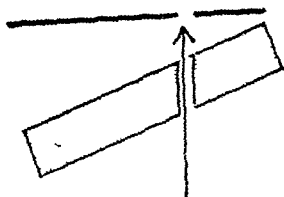
FIG 12 —Shows how oblique fracture can be demonstrated by rotating wrist
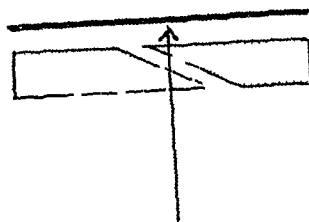
FIG 13 —Shows that no clear band will be seen if the incident ray does not pass vertically through fracture

This discussion on the radiography of the scaphoid leads up to the question of variations in the position of the scaphoid in accordance with variations in the position of the hand as a whole   This is of more than merely academic or radiological importance, for it has a very practical bearing upon the mechanism of the production of fracture, or, rather, of the various fractures   The question has been studied by dissections, both in the cadaver and in the living patient but by far the best idea can be obtained by carefully studying a series of stereoscopic views of the carpus, taken in various positions   To anyone who has not tried this method, it will come as a revelation , the views obtainable are very beautiful, and give one a wholly new conception of what happens to the various parts of the carpus during various movements   Moreover the results thus obtained are necessarily much more reliable than those obtained under the very artificial conditions of dead-house dissection where all the surrounding soft parts have to be cut away before the bones can be studied

The first and most obvious fact that we note about the movements of the scaphoid is, that when the hand is radially deflected (or abducted) it slides well under cover of the lower articular surface of the radius (Fig 8) whilst when the hand is ulnar deflected (or adducted) the scaphoid is dragged out of this cover, and becomes perhaps more exposed to injury (Fig 5)   In many radiograms it even appears that the scaphoid tends to leave the radius so that there is a clear space seen between the lower border of the radius and the upper border of the scaphoid whilst there is evidently an ample radiocarpal space in which the scaphoid can lie (Fig 5)

When the hand is radially deflected however the scaphoid is thrust up against the radius, and the radiocarpal space for the bone is minimal Over and above the purely lateral movement of the scaphoid Nogier[15] has described a pseudo luxation of the bone by which he means an anteroposterior

FIG 14 —Normal carpus in extension

tilting of the scaphoid during radial deflection   the bone tilts in a dorsi-palmar direction so that the tuberosity comes forward and appears much more foreshortened than it really is   in other words in abduction of the wrist the scaphoid comes to lie much more nearly

at a right angle with the long axis of the forearm than it normally does   (In its normal position, it makes an angle of about 45° with the long axis) This increased tilting of the bone with radial deflection of the wrist explains of course the superimposing of the shadow of the tuberosity upon that of the body of the bone, as explained above (*Figs* 8, 9, and especially *Fig* 24)   If the wrist joint be extended, the tilting goes a stage further, and the scaphoid comes to be practically perpendicular to the long axis of the forearm, and lies in close contact with the lower articular surface of the radius and its styloid process (*Fig* 14)

From a study of the radiograms here reproduced it is easy to see that in all positions of the wrist, the body of the scaphoid continues to act as a buffer between the os magnum and the radius, and to transmit force to the radius from the outer column of the carpus and metacarpus , however much it may project, it least the bone never escapes from its radiocarpal pocket   In certain positions the body of the bone must obviously be pinned very securely between the radius on the one side and the os magnum on the other whilst the projecting tuberosity is subjected to various forces, direct or indirect, by which fracture may be produced   Moreover, the scaphoid is adapted to act as a buffer, not only because of its position, but also in virtue of its very structure, for it is mechanically weaker than either the radius or the os magnum , it serves admirably, therefore, to dissipate force transmitted through it, but is liable to suffer in the process   In order to allow of a certain amount of gliding during this force-dissipating or force distributing process, the scaphoid is left by nature comparatively free from attachments   it is anchored to the os magnum and to the semilunar by an interosseous ligament , but it is quite free from the trapezium, the trapezoid, and the radius, whilst none of the thenar or any other muscles are attached to it, and the anterior annular ligament is attached only to the proximal part of it   We shall see, later, that this comparative detachment from neighbouring structures, though no doubt it has its advantages, has also a great deal to do with the marked tendency to non-union which fractures of this bone display

There has been much acrimonious discussion as to whether all those cases in which a radiogram clearly shows a partition of the scaphoid are really cases of fracture   Many authorities maintain that there exists a condition of bipartite scaphoid, which is quite independent of fracture, and is probably a developmental freak   Their opponents contend that all the cases described as bipartite scaphoids are really cases of old ununited fracture   No doubt fracture of the scaphoid does frequently occur in cases diagnosed and treated as sprains of the wrist, and non-union inevitably follows , a pseudarthrosis develops between the fragments, and if there is little or no callus exuberance, and little arthritis, it is very easy indeed to mistake the radiographic appearances for those of bipartite scaphoid   It is assumed that in many of the cases described as bipartite scaphoid there was really a fracture, and that the accident has been forgotten   But even allowing for the extraordinary stupidity and forgetfulness of some classes of patient (so that one has even seen cases of bony ankylosis of the hip in which no history of previous pain or illness could be extracted), it is almost inconceivable that a grown up person could completely forget the accident that would lead to a fracture of the carpus   The youngest age at which this fracture has been recorded is 15 years, and the average age is 24 years   It must not be forgotten that these fractures only occur in adults, and only after considerable violence   Nevertheless, it cannot be denied that nearly all the 'bipartite scaphoids that have been described have been found in cadavera, and that a routine search amongst live patients, by means of the x rays, fails to reveal the condition in anything approaching the frequency which the champions of the bipartite bone assert to be normal   They say that bipartite scaphoid occurs in 1 per cent of normal human beings and that the bone is partly cleft in as many as 2 per cent   In not one of all the radiograms examined in connection with this article has any example been found, nor can I remember ever to have seen one whilst examining wrists with the x rays for any purpose whatsoever

But though we may not concede that partition of the scaphoid is common, we can hardly deny that it sometimes occurs   There is much evidence, hard to controvert, to show that it does   In the first place, partition of the scaphoid is almost always bilateral,

whereas fracture of the scaphoid rarely is (only 1 in 18 cases)   Next, it has been demonstrated by quite a number of independent observers, including Rambaud, Renault Bardeleben, and Thilenius, that there are often two, and occasionally even three, ossific centres in a human scaphoid , normally these unite and form one, which is clearly seen with x rays at six years of age, but remains cartilaginous and cushion-like up to sixteen years, and then begins to ossify throughout   It is easy to appreciate that sometimes these separate ossific centres might fail to unite in the ordinary way   sometimes they fail entirely, when the condition of bipartite scaphoid is produced, and sometimes they fail partially, when there is produced a cleft or notched scaphoid   The statement that the scaphoid might sometimes be bipartite seems to have been made first of all by Wenzel Gruber in 1865 but the first really authoritative work on the subject was that of Pfitzner, published in 1900   he investigated 1456 wrists from this particular point of view, and found amongst them 9 cases in which the scaphoid was completely bipartite (7 left and 2 right), and 29 cases in which it was partially cleft (15 left and 14 right)   In these cases, the outer bone articulates with the os magnum, trapezium and trapezoid, and the inner articulates with the radius, semilunar, and os magnum , this arrangement is constant   The outer part is to be regarded as the true scaphoid, and the inner as a metascaphoid   Sometimes there is an os centrale is well in these cases, and it may either be present as a separate bone, or may be fused partly or completely with the radial or true scaphoid   In Pfitzner's article will be found a full bibliography of bipartite scaphoid   It also includes a romantic account of the discovery of the first os centrale , the distinguished morphologist, Dwight, had prophesied its existence long before any example of it had been found, basing his assertion on studies in comparative anatomy, and on the examination of the carpus in the skeletons of prehistoric men   years later, the os centrale was discovered by the aid of x rays in a living man's hand   The whole story reminds one of the foretelling of the existence of various chemical elements and their physical properties from a study of the atomic series, and the ultimate discovery of each of them   The existence of iodine, for example, and its properties, were forecasted successfully in this way, and the same is true of several of the rare metals lately discovered

Pfitzner worked out a sort of schema of the human wrist, in which there appears not only an os centrale, but also an os scaphoideum radiale and an os scaphoideum ulnare , this schema was based on comparative anatomy   The os centrale has been shown to exist , enthusiasts will probably say that this is an argument in favour of the other bones also existing, and they will say that the bipartite scaphoid is the living representation of the theoretical os scaphoideum radiale and the os scaphoideum ulnare   In actual fact, however, the bipartite scaphoid has not been demonstrated as often as one would have expected , Pfitzner says that he found the bone completely cleft in ½ per cent of all wrists examined in his series of 1456 , Codman and Chase,[11] however, ' did not find a single divided scaphoid that was not definitely associated with injury   in a series of 1040 wrists that they examined   They therefore consider that bipartite scaphoid is so rare that it cannot be held to account for the comparatively common cases of apparent fracture (amounting to ½ per cent of all fractures in fact)   Another important point is that, at operation, the adjacent surfaces of the bones are always found to be rough, and to consist of cancellous bone whereas in true bipartite scaphoid, articular cartilage would always be found clothing them and it would be perfectly smooth and glistening

The lack of confirmation for Pfitzner's findings is a very telling point against those who believe in bipartite scaphoid, for an ounce of practice is worth a pound of theorizing nevertheless there are certain other points to be borne in mind which support their claims to some extent   (1) The condition is sometimes associated with other developmental anomalies, such as webbing of the fingers, premature synostosis of the phalanges If one developmental peculiarity exists, it rather strengthens the belief that any other abnormality present is of developmental origin also   (2) In a fair proportion of cases (though not in many of Pfitzner's) the condition seen is bilateral, whereas bilateral fracture of the scaphoid is admitted by every one to be exceedingly uncommon (3) Complete absence of any history of injury—we have dealt with this point above

To sum up, I think we must admit that the evidence is so strong, and the arguments are so good, that one cannot deny that partition of the scaphoid does sometimes occur as a developmental reversion, but it is probable that many, and perhaps most, of the cases actually described have been ordinary cases of 'missed' fracture of the scaphoid. The truth lies, as usual, midway between the two extreme views that have been put forward.

FIG 15 —Comminuted scaphoid and oblique fracture of lower end of radius (involving articular surface) Anteversion of fragment Direct injury

Next, let us study the radiographic appearances of the various types of fracture that occur, and consider how they are produced. The ordinary text-books talk about 'fracture' of the scaphoid, but there are in reality several perfectly distinct varieties, this is why the present article has been entitled, " Fractures (and not Fracture) of the Scaphoid

FIGS 16 17 —Transverse or snapped waist fracture of scaphoid produced in abducted position of carpus as always

The several types connote several different mechanisms, and, armed with a precise knowledge of the normal anatomy and function of the scaphoid, it should not prove difficult to work out these mechanisms

The commonest fracture is a clean snap across the waist of the bone Usually the

break is at the middle of the bone, which is its slenderest part, but sometimes it is nearer to one or other end   Obviously this difference depends upon the position in which the bone (i e , the carpus) happens to be held at the time of the injury   It is also evident that the fracture must be produced by an indirect force, of the snapping variety, and not by a crush or other direct injury,   One part of the bone, presumably, must be tightly gripped whilst force is being applied to the other part   Two-thirds of all fractures of the scaphoid are of this 'snapped-waist' variety (66 per cent to be precise) (*Figs* 6, 16, 17, 18)

When a clear account of the accident can be obtained, it is always to the effect that the hand was abducted at the time   We saw, it will be remembered, that when the hand was abducted, the scaphoid was firmly jammed between the os magnum on the one side and the lower end of the radius on the other, also, we saw that in this position the scaphoid became more or less vertical, and whilst in this position it served as a buffer to dissipate force applied to the distal part of the hand, i e , the carpus or metacarpus   The dorsal part of the bone is very firmly held, but the palmar end is held less firmly, and projects somewhat from the radiocarpal socket (*Figs* 6 and 16), therefore the scaphoid yields at its weakest point, viz , the middle   In other words, the line of fracture usually continues the midcarpal interline   If abduction is less extreme at the moment of impact, the fracture will be nearer to the ulnar end of the bone   A fall upon the outstretched hand is the commonest type of accident, but backfires when starting up motor cars are sometimes held responsible   At any rate, the violence is always applied indirectly   Of all the authors who have written on fractures of the scaphoid, de Fortunet alone thinks that direct injury (*Fig* 19) is a common mechanism, and certainly it cannot be the mechanism of the snapped-waist variety, which is the commonest fracture   Speese[64] talks of two kinds of transverse fracture (i e , 'split-waist' fractures), one associated with compression, and the other without it   It is conceivable that at the extreme limit of radial deflection of the hand the scaphoid might impact upon the styloid process of the radius (*Fig* 8), and, if it failed to break it, it might itself be somewhat crushed together and compressed in the process , but this seems improbable when we recall the vertical pseudoluxation which occurs in the scaphoid in this position   It is far more likely that the apparent 'compression' is simply callus resulting from the repair of an ordinary transverse fracture   I have yet to see a recent fracture of the scaphoid, produced during abduction of the hand, in which the immediate radiogram shows any sign of compression

Radial deflection of the hand, together with some degree of extension of the wrist-joint (such as occurs in falls upon the outstretched palm), is responsible not only for transverse fracture of the scaphoid but also for a certain fracture of the radius which, as far as I can discover, was first accurately described by Vialle of Lyons   I mean the very

Fig 18 —Old fracture of waist of scaphoid
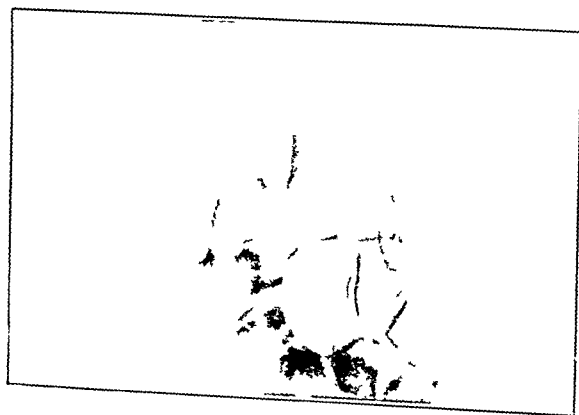
Fig 19   Comminuted fracture, produced by direct injury

characteristic fracture of the posterior lip of the lower articular surface of the radius, it is a fracture which is very constant in type, and quite familiar to anyone who sees a number of forearm fractures, but its mechanism, and the part played therein by the scaphoid, have not hitherto been clearly described and appreciated The splitting-off of the piece of radius usually follows a line that runs obliquely upwards and outwards, as one would expect, seeing that the hand is abducted at the time of impact (*Fig* 10) A lateral view, in these cases, will show that it is only the posterior lip of the radius that has been chipped off and displaced, and not its whole thickness Sometimes the scaphoid breaks the radius as it strikes it, but escapes injury itself, as in *Figs* 10 and 24, at other times both bones may be broken, as in *Figs* 20 and 21, whilst on other occasions it is the scaphoid alone which gives way, no doubt this is partly due to its

FIGS 20 21 —Fracture of scaphoid and of radius by scaphoid (a severe degree of Vaille s fracture)

being structurally weaker than either the os magnum or the radius

Another variety of injury which occasionally occurs in association with fracture of the scaphoid is fracture of the lower radial epiphysis An example of this is seen in *Fig* 7, which shows a definite vertical fracture without displacement through the lower epiphysis of the left radius in this same patient there was produced simultaneously a fracture of the right scaphoid *Fig* 6 is another view of the same patient, taken with the two wrists side by side, and in this picture the existence of the fracture of the radial epiphysis is masked |by the overlapping of the semilunar This illustrates the importance of taking several views at various angles in difficult cases of fracture about the carpus

Of those who have written about the mechanism of fracture of the scaphoid, Vaille,[66] Princeteau,[57] John B Murphy,[47] Jaboulay,[32] and Destot[15 16] have all taken the view that fracture was normally produced by a fall upon the abducted hand

Fracture also occurs in adduction, or ulnar deflection, of the hand, but this is much less common The usual form of violence is a backfire, so that we have a combination of ulnar deflection and forcible extension of the wrist-joint This may produce sudden extreme tension of the external radioscaphoid ligament which is attached to the tuberosity of the bone, and this may be avulsed, the fracture is perfectly characteristic, and if one knows accurately the nature of the force applied, the existence of a fracture of this type can be prophesied safely (*Fig* 22) This is not at all a common form of fracture of the scaphoid, it has been described by J B Murphy,[47] and also by Speese,[61] thus making three types described by the latter author, viz, the transverse fracture with compression, the transverse fracture without compression, and the avulsed-

FIG 22 —Fracture of the avulsed tuber osity type produced in adduction or ulnar deflection of carpu

tuberosity type   When extension of the wrist is extreme, impaction may occur, or sometimes comminution, from compression   McCarty[39] alone thinks that ulnar deflection is the commonest mechanism of fractures of the scaphoid, he thinks that it is in this position that the ordinary 'snapped-waist' type is produced, he argues that in ulnar deflection plus hyperextension of the wrist, the scaphoid projects beyond the radius the distal end is firmly fixed by ligaments, but the proximal fragment is mobile, being articular, and attached solely to the anterior annular ligament, therefore, he says, it is between the two that the bone gives way

The third, and by far the larest, mechanism consists in fracture of the scaphoid during hyperflexion of the wrist   In this position (*Fig 23*), the two rows of carpal bones try to separate from one another, the tendency is for the first row of bones to move forwards and the second row backwards, the radio-carpal socket of the scaphoid is widely opened up, and as the bone is only supported behind by the tendons of the extensores carpi radialis longior and brevior, it follows that very often it becomes dislocated   Such a dislocation is, in fact but the first stage of an intercarpal dislocation   In other instances, however the

FIG 23—Normal carpus in hyperflexion

scaphoid is broken, the reason being that the bone in this position practically enters into the formation of both rows of the carpus, and it naturally follows that if one part tries to move in one direction, and the other part in the reverse direction, fracture must ensue MacLennan[40] has advanced the view that fracture of the scaphoid is usually produced during hyperflexion of the wrist, the lower or most posterior part of the joint receiving the main impact, in such a case there may be fracture of the lower part of the radius

FIG 24—Fracture of radius by scaphoid   Vialle type

as well, Vialle[66] and Vallas have recognized that fracture may be produced in this way, though they do not go so far as to say that it is the common way   In the Guy's series there has been no example of an injury of this type

A knowledge of the mechanism of production of the several fractures of the scaphoid is of more than academic interest, for it will help to put us on our guard in their diagnosis   If, in examining cases of injury of the wrist the likelihood of fracture of the scaphoid is always borne in mind, it is most improbable that such a fracture will ever be overlooked   Moreover when the three cardinal signs of the fracture are present (viz, acute local tenderness, limitation of extension of the wrist, and œdema running up the dorsum of the wrist in its outer half, along the tendons), one can go further, and say that fracture of the scaphoid is actually present

In all the recent cases that I have seen, the diagnosis was definitely determined on clinical grounds before an x ray picture was made, and in every case the diagnosis was confirmed   Furthermore, in no case has a diagnosis of fracture of the scaphoid ever

been made without its being subsequently proved to be correct In some cases, when the exact position of the hand at the time of impact can be elicited, one can go even further with the elaboration of the diagnosis, and predict from the mechanism the exact type of fracture that will be found

A radiogram cannot be regarded as an infallible means of determining whether a fracture of the scaphoid has united or not, but in many cases it gives a very clear indication, and conclusions drawn from radiograms have frequently proved at operation to be quite correct The commonest observation that one makes, in old fractures, is that they have remained ununited More than three-quarters of all the old cases seen at the present time show non-union, and it appears, from a comparison of these cases with others in which union has taken place, that the greater part of their disability is due to the non union and the secondary results to which it gives rise At operation it is found that the opposed surfaces of the pieces are not covered with smooth articular cartilage (as they would be in cases of true bipartite scaphoid), or with glistening fibrous tissue, or pseudo cartilage, but that they are rough, and grate when rubbed together, moreover, there is very often some slight exuberance of callus upon the articular surfaces of the bone, and one can well imagine that such a rough material, scraping against the polished lower end of the radius, might cause a sudden twinge of pain, and make a man drop his tools Sometimes there is definite evidence of chronic local arthritis of the joint in the shape of reddening and thickening of the soft parts, and a slight increase in the quantity and viscidity of the synovial fluid Not only inside the joint, but around it also, there may be evidence of chronic irritation, if so, the prognosis is so much the more grave, for in this, as in all articular and para-articular fractures, the effect of the injury upon the joint is far more important than its effect upon the bone itself It is often said that the chief reason for the non-union is deprivation of blood supply, consequent upon the injury, but as the scaphoid normally receives its main blood-supply by way of the ligaments attached to it, and as these are seldom or never ruptured, it is rather difficult to see how this oft repeated explanation applies

Preiser[5] has contributed some interesting cases, in which he has shown that injury of the wrist may be followed by a central absorptive process going on in the scaphoid, the so-called 'rarefying osteitis, and a bone thus weakened may subsequently undergo pathological fracture, he suggests that the area of increased transradiancy seen in his x ray photographs is due to absorption of the bone caused by rupture of the nutrient blood-vessels His pictures show the central areas of absorption in these damaged, but unbroken, scaphoids very clearly, and one can easily imagine that after fracture a similar absorptive process might go on in the two halves of the bone, and lead to non-union and formation of a pseudarthrosis between them In a few cases where the bone was excised a few days after fracture and carefully sectioned, it has been found that the middle of it was occupied by recent clot and liquid blood in others, cystic degeneration has been described, and has been attributed to osteitis fibrosa following the injury

Seeing that the normal nutrition of the scaphoid is by way of the ligamentous structures attached to it, and that these are rarely detached, it seems difficult to adopt a purely vascular lesion as the explanation of the frequent non-union It seems much more likely that the fact of the fracture being entirely intra-articular has a great bearing upon the question It is always bathed in excess of synovial fluid, and we know, from the analogy of other joint-injuries, that synovia does tend to exert an inhibitory action upon plastic processes Indeed, in a normal healthy joint that is one of its most important protective functions A third factor that plays a large part, no doubt in producing non union is undue mobility, for, as we have seen, most of these fractures are overlooked and not adequately rested

One English author alone, as far as I can discover, advocates massage and mobilization from the very first he says, writing in 1911, that carpal fractures occurring alone need no splint that a large degree of freedom can be permitted from the outset, also, that bony union is the rule, that restitution of functional utility should be complete in three

weeks, that the formation of callus, given proper massage treatment, is unknown, and that even if bony union fails to occur, the patient suffers no inconvenience The majority of surgeons hold diametrically opposite views As regards the scaphoid, at any rate, it is held that early movements are one of the main causes, if not the most important cause, of non-union And certainly, if we examine our patients' histories carefully, non-union does involve a very grave disability in the majority of cases, the hand is painless if kept still, but is weak and untrustworthy in use As Codman and Chase[11] say, " If the fracture remains ununited, the permanent disability is so great that it seriously interferes not only with the comfort of the patient, but with his ability to enjoy certain games and sports, and also, in the case of working men, it limits their working capacity, and hence their ability to earn their living " These writers found only three cases out of their series of thirty in which the wrist had been kept on splints for a time, and in all three bony union had taken place, and, in our own series, union has occurred in all the recent cases, after three or four weeks' rest upon a wooden or metal 'cock-up' splint There is therefore considerable evidence to show that early movement, in the case of this fracture, is most prejudicial, and largely responsible for the production of the non-union One must, of course, go a stage further with the argument, and inquire whether non-union is the chief reason for the disability, and whether function is always good in those cases in which union has taken place It will be found, on investigating the after-histories of a series of patients, that function is always very much better in the united than in the non-united cases, in the writer's experience, the average time taken before a man was able to resume his full work was about eight weeks after the splints were removed, i e, eleven to twelve weeks from the time of fracture This may seem rather a long time, but it must be remembered that the majority of these patients are men whose occupations are laborious, such as that of stone-mason, 'bus conductor, wheel-wright, etc Moreover, twelve weeks is not a long time to spend on getting an injured wrist well, if the alternative is a joint that will be troublesome for the rest of the man's life

As a routine treatment for a recent case, therefore, we strongly advocate preliminary splinting for three or four weeks, followed by mobilization and the employment of all the usual physiotherapeutic measures, such as whirlpool baths, contrast baths, or radiant-heat baths The writer has not been able to make out that the results of four weeks fixation were any better than those of three weeks' splinting, and has therefore adopted the shorter period, and as regards the type of splint to be employed, a long 'cock-up' has been uniformly used, on the principle that if stiffness should ensue, it is better to have the wrist stiff in extension than in any other position, because that is its position of activity

Absolute immobilization in the strictest sense of the word, has not been attempted, nor has it been found necessary, resting the fingers and wrist upon a full-length cock-up splint for three weeks has proved sufficient to ensure bony union, massage upon the splint has been employed after the first week, with the object of promoting absorption of inflammatory products, allaying spasm of muscle, and improving the blood-supply

The principle of treatment, then, is very like that which we adopt in the much more common injury, the so called separation of the lower humeral epiphysis, that is to say, we rest the parts at first, in order that over-production of bone within the joint may be avoided, keeping the joint meanwhile in the position of maximum usefulness, then, when the hyperæmia and other callus-promoting conditions have subsided somewhat, we proceed to restore mobility and function generally

Generally speaking, the functional result is good in cases of fracture of the scaphoid when this principle is followed, in some few cases it is not, and in these as well as in a number of cases in which the initial treatment has been faulty, operation has been tried A large number of such cases have been recorded, and the results seem to have varied enormously Some authors say that their functional results have been perfect others, that they have effected little or no improvement, and many take a sort of mid-position,

claiming that if they have not cured their patients, they have at least given them more useful wrists One writer, for instance, says, " Operation will ultimately give a good joint It will not result in a wrist of normal strength and flexibility, but it will give a strong painless joint which is limited in the extremes of motion When disability is pronounced and the hands are constantly used, the benefit from relief of pain may be sufficient to warrant risking a loss of strength "

There can be no doubt at any rate, that the results of operation in late cases of fracture of the scaphoid often leave much to be desired, and it is quite impossible for a surgeon to guarantee restoration of function to a patient to whom he is proposing operation In many of the published cases of excision of one or both of the fragments, there has remained a marked degree of stiffness of the wrist, or of loss of power , several authors give some indication of the amount of permanent disablement when they say that they assess it as 30 per cent, or that the patient was only able to lift three or four kilos with the injured hand, whilst he could lift thirty to forty with the good hand And there are undoubtedly many cases which have not been published, in which excision of one or both fragments has failed to effect much improvement If relief of pain be all that the surgeon hopes to attain by operating, then the same result can be secured much more simply by providing the patient with a blocked-leather case, enclosing the forearm and wrist, by which means painful extension and sudden wrenches will be avoided

The reason why operation has often failed and yet sometimes succeeds is not far to seek it is simply that it is often carried out too late The disability, as we have seen, is due to the arthritis and peri-arthritis, and not to the non union *per se* , and if the fragments are not removed till the arthritis has been set up, and the arthritis persists, it is clear that such an operation must be foredoomed to failure Operation can only succeed if it is done early The proper course is to try splinting for three weeks, followed by massage, mobilization, and physiotherapy for anything up to three months , and if, by that time, function has not been restored and the patient still complains of pain on movement, it is probably wise to advise operation forthwith Codman and Chase quote the case of a surgeon, in which early operation was performed with the most gratifying result , and Pforringer[34] mentions another, in which excision of the whole scaphoid was followed by complete disappearance of pain, and the patient was enabled to lift and carry a 50 lb weight without difficulty

It is quite clear that late operations are almost always disappointing, and that if operation is to be employed at all, it should be before the condition of chronic arthritis has been set up

The technique of the operation is quite simple, and it can, if desired, be performed under local analgesia An incision is made on the dorsum of the wrist, along the anatomical snuff-box , it is deepened, the radial nerve and artery being held aside , it goes down parallel with the tendon of the extensor carpi radialis longior, and to the inner side of it care being taken to avoid opening its tendon-sheath , the bone having been removed, the skin is sutured, no attempt being made to close the joint capsule The wrist is bound up, and the patient is encouraged to make such movements as the bandages allow from the very first, and a little later on massage is instituted It is apparently immaterial whether the whole scaphoid is removed, or only a part of it , the wrist is certainly not weakened in any perceptible manner by the removal of the whole bone, but the results of operation seem to have been as good when the proximal fragment alone has been excised

The Lyons school of surgeons maintain that ablation of the scaphoid alone is 'quite inadequate' and that it has no effect upon the arthritis present—as one would expect Vialle,[66] and also Vallas,[66] advocate formal excision of the wrist joint, and describe their results as 'very good' No details are given, however, and it is difficult to believe that such drastic treatment could really restore full function to a labouring man s right wrist

From all that has been written about fractures of the scaphoid, and the many conflicting accounts that have been given of the results of various treatments, one fact

emerges most clearly, viz., that all methods of late treatment are uncertain and unsatisfactory. It is evident that accurate diagnosis of the fracture in the first instance is essential to uniform success in treatment, and given that a surgeon knows that there is an intra-articular fracture present, it should generally be possible for him to devise such a plan of treatment as will result in bony union of the fragments without callus excess. In some few cases (e.g., those in which comminution of the bone is present), this may not be possible, and it is in these cases that early, or possibly primary, operation should be carried out.

The main object of this paper has been to show that fractures of the carpal scaphoid are really very characteristic, and have well-marked and almost pathognomonic physical signs, that they should always be diagnosed at the time when they occur, because it is only then that treatment is capable of restoring a useful degree of function, and, lastly, that failure to diagnose these fractures, though very common at the present time, is fraught with the most serious consequences for the patient, inasmuch as it means that he will almost certainly have a permanently crippled wrist, in spite of all the treatments that he may undergo.

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THE PALLIATIVE TREATMENT OF ANEURYSM BY 'WIRING' WITH COLT'S APPARATUS.

By Sir D'ARCY POWER K B E London

PATHOLOGICAL aneurysms, the result of chronic inflammation of the large arteries in the chest and abdomen, are of so deadly a nature and run such a distressing course, that any means of relieving the symptoms, even temporarily, must be welcomed by every one who is brought in contact with the unfortunate sufferers, and the means is doubly welcome if it offers even a remote chance of a cure. I make no excuse, therefore, in directing attention to a method of relieving the pain which is so constant a feature of the disease.

The apparatus employed was invented by my former house-surgeon, Mr G H Colt. Its object is to enable a known quantity of wire to be introduced into the sac of a aneurysm with the least disturbance of parts, the maximum of speed, and the certainty of asepsis. Entrance of wire into the aorta, which is known to have occurred in at least seven cases, is also prevented. The instrument (*Fig* 25) consists of a trocar and cannula, a ramrod, a tube, and a wisp. The wisp consists of a number of fine steel wires soldered together at one end, each wire being curled over in a separate plane so that it readily expands as soon as it is set free from any controlling force, though under ordinary conditions the wires are packed together and the individual strands lie parallel to each other. The wisp, in fact, is like a miniature umbrella which has a constant tendency to remain open ; the end where the wires are soldered together is the handle of the umbrella, and the individual wires are the ribs. Originally a double wisp or 'cage' with the wires soldered together in the middle (as illustrated) was intended to be used for a large sac ; but it was found that the second half of the cage did not expand with certainty after its insertion, so that its use has been discontinued. Each wisp fits into a hollow metal tube—open at both ends—so fashioned that it can be fitted easily and accurately to the distal end of the cannula after the trocar has been withdrawn. It then forms an extension of the cannula. This tube holds the wisp in its compressed condition as a bundle of wires lying side by side. The wisps are made of different sizes for use with different-sized aneurysms. The amount of wire in each is known, and is always the same for the same size. Thus, No 1 wisp has a total surface area of $1\frac{1}{4}$ square inches and is composed of 75 inches of wire ; wisp No 2—the one generally used—has a surface of $2\frac{1}{2}$ square inches and the total amount of wire is 105 inches ; and wisp No 3 has $3\frac{1}{2}$ square inches and consists of 150 inches of wire. The wires composing the wisps are dull gilt, and if they be examined under the microscope or passed through the fingers the gilding will be found to have made them slightly granular. This irregularity of surface is intentional, and enables the blood clot to form more quickly and to adhere more firmly than if the wires were smooth.

Every part of the apparatus can be sterilized by being boiled, and the method of using it is very simple. Care must first be taken to ascertain that the wisp expands freely as soon as it leaves the tube. The skin over the most pulsatile portion of the aneurysm is divided, and the trocar and cannula are thrust into the sac. The trocar is then withdrawn, and a jet of blood issues with considerable force if the cavity of the aneurysm has been reached. The tube containing the wisp is then fitted to the projecting end of the cannula, and the wisp is pushed into the aneurysm by means of the ramrod. If this be done steadily and gently the wisp is entirely released and falls into the cavity of the aneurysm the expanding wires first and the soldered end last. The cannula is then withdrawn, and the skin incision is closed with a single point suture if necessary. Hitherto,

each operation has been performed under a general anæsthetic, but I believe local anæsthesia would be quite sufficient in most cases. I began by making a considerable incision in order to expose the sac, but now I merely puncture the skin to prevent the point of the trocar carrying epithelial cells in front of it into the aneurysm

Experience has taught me one or two points of importance in performing the operation. In the first place it is necessary to have a free jet of blood issuing from the cannula when the trocar is withdrawn; it is then certain that the whole thickness of the wall of the aneurysm has been pierced, and the wisp will be delivered into the fluid blood, for it will be useless if it merely lies in the active or pre-existing laminated clot

The introduction of the wisp by means of the ramrod should be done deliberately, and the cannula withdrawn afterwards steadily and without jerking, or the wisp may jump out of the puncture, as happened in one of my cases (vide p. 29) when I attempted to operate too quickly. Even in a large thoracic aneurysm the wall of the sac is sufficiently elastic to prevent any escape of blood when the cannula has been withdrawn. This fact had to be learnt by experience. I feared at first that the puncture would
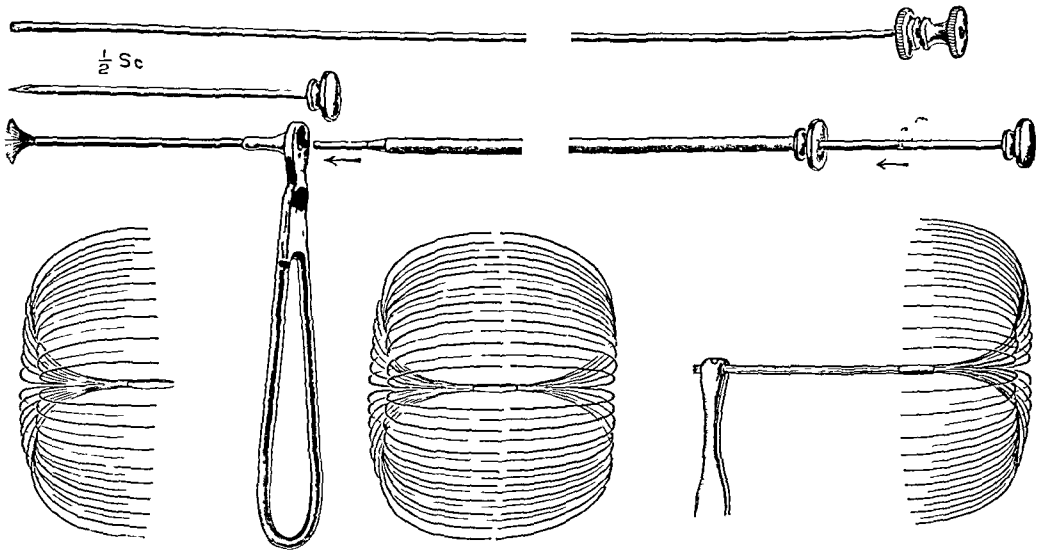
Fig. 25 —Mr C H Colt's apparatus for wiring aneurysm

continue to bleed, and I used to suture the wall at the seat of puncture and reinforce it in the neighbourhood with a few additional sutures, until I saw this precaution was unnecessary, for there was no bleeding when the cannula was drawn out. I have, therefore, abandoned suturing in my later cases. The operation is attended with so little pain or after disturbance that narcotics are often not needed; indeed it is better not to give them, because the patient has usually suffered so much that he craves for them, and the operation is a good opportunity to break him of the habit. Where the pain is severe, full doses of aspirin are usually sufficient, especially if the patient can be assured that within a few hours, or at most a day or two, the pain will disappear

The following are details of my last three cases; the result of the third is still incomplete, for the patient is alive and doing her ordinary housework

Case 1 —A shopkeeper, age 38, was admitted into St Bartholomew's Hospital under the care of my colleague, Dr James Calvert, on July 16, 1915. He stated that he had suffered from a pain in his chest for the last eighteen months, the pain having begun after he had made a sudden muscular effort. It gradually got worse, and during the last seven months it had been severe. He had kept his bed for the past seven weeks. He had served in the army, but on the whole had not led a strenuous life, and he had always been temperate. The patient was a tall, thin, and pale man, who lay curled up in bed on his right side. Movement caused pain in his chest which he said

was shooting in character and ran from the scapula down his back   It was made worse by coughing   The cough was dry, and in the later stages was accompanied by stridor, the breathing was oppressed, and deep inspiration caused pain   The pupils were equal and reacted sluggishly to light and accommodation   The Wassermann test was strongly positive

A well defined swelling could be seen pulsating on the right side of the chest   It extended from the margin of the sternum to the interior axillary fold, and from the third to the sixth rib   The pulsation was expansile   Air entry over the right lung was diminished, and the percussion note was impaired all over the back, with occasional patches of bronchial breathing   The apex beat was in the sixth space, and was palpable from the sternum outwards for two inches   The heart sounds were muffled, and a systolic murmur was audible at the apex, in the epigastrium, and over the tumour   The liver reached an inch below the costal margin in the nipple line   The urine contained much albumin   X-ray examination showed a large saccular aneurysm of the ascending part of the arch of the aorta   On July 23, 1915, the patient being under a general anæsthetic, I made an incision ¾ in long over the most prominent part of the swelling and punctured the aneurysm by means of Colt's apparatus   A No 3 wisp was introduced, but on annula the wisp shot out of the sac with considerable violence and fell on the   I had another wisp ready sterilized, so I made a second puncture into the sac and introduced a wisp of the same size   Blood issued freely from each puncture when the trocar was withdrawn, but there was no hæmorrhage when the cannula was pulled out, so it was not necessary to suture the sac   The skin was closed with two point sutures of silkworm gut

The operation was followed by cough and dyspnœa   The temperature rose to 100·4° F and the pulse to 120 for a few hours, but the temperature soon fell to normal and the pulse rate diminished   The pain, however, was not relieved, the dyspnœa increased, and the swelling in the chest got steadily larger   The patient died eleven days after the operation   The post-mortem examination showed the body of a well-developed man with a marked swelling in the right pectoral region, over which was a small and recently healed wound where the aneurysm had been wired   The right lung was collapsed and was lying at the back of the pleural cavity   There were many adhesions of the right pleura, and the cavity contained blood-stained fluid   The chest contents, together with a portion of the thoracic wall involved in the swelling, were removed entire and sent to the museum to be hardened before a more detailed examination was made   The pericardium and heart were evidently not normal, and there appeared to be a large aneurysm of the ascending aorta which projected in part into the pericardium, but for the greater part was external to it and had 'bulged' the chest wall   The aneurysm had not ruptured   Subsequent inquiry showed that the specimen had neither been examined nor preserved   I think that I should have done better not to have operated in this case, but to have let the disease take its natural course   The patient was very ill he was worn out by pain, and he had albuminuria   I hoped, however, that I might have relieved his pain

Case 2 —A dock labourer, age 51, was admitted into St Bartholomew's Hospital under the care of my colleague, Sir Percival Horton-Smith Hartley, on Jan 14, 1916, complaining of a lump in the front of his chest   He said that in 1914 he had fallen down suddenly in the street whilst on his way home from work and had been taken to the London Hospital, where he was found to be suffering from left hemiplegia   He was kept in the hospital for sixteen days, and his left arm had remained weak ever since the attack   Eight months ago he began to feel a dull pain over the front of the chest, and six months later he noticed a lump in the front of the chest on the right side   The swelling had gradually increased in size   His voice was husky, but he had not experienced any trouble in swallowing   Examination of the chest showed many dilated veins with slight œdema   There was a visible tumour—showing expansile pulsation—situated to the right of the sternum   The note over the tumour was dull, the dullness extending from the second to the fourth rib, and for four inches to the right of the sternum   There was a systolic thrill and a murmur over the swelling, which x-ray examination showed to be an aneurysm of the ascending part of the arch of the aorta measuring 4½ inches vertically and 3 inches horizontally

The patient was kept in bed under the care of Sir Percival Hartley from Jan 14 until Feb 21, on a light diet and with restricted fluids   He was given full doses of potassium iodide as his Wassermann test was positive   The tumour increased in size steadily in spite of this treatment and the patient complained bitterly of pain

I wired the aneurysm on Feb 21, 1916, using Colt's apparatus and introducing a No 2 wisp, which presented a clotting surface of 2½ square inches and consisted of 105 inches of wire

The patient being under a general anæsthetic, a semicircular incision was made over the tumour beginning at the second right costal cartilage and extending downwards over the third costal cartilage   This was deepened until the pectoralis major was exposed, the fibres of the muscle were separated, and the sac of the aneurysm was seen as a bluish membrane of the consistency of thin parchment   The sac pulsated freely and it was obvious that it did not contain much clot   A trocar and cannula were introduced, and a full stream of dark-coloured blood spurted out for some distance as soon as the trocar was withdrawn   The No 2 wisp was introduced without difficulty and the cannula was withdrawn   Blood still continued to issue from the puncture, which was closed with a single point suture of No 2 silk on a round curved intestinal needle   The patient did not sleep much during the night, but he was fairly comfortable by eleven o'clock the next morning   He had a slight bronchitic cough which increased his pain

The temperature was 99 4° and the pulse 84   On Feb 24 he stated that he was free from pain, and on March 6 he left the hospital   The patient was seen eleven weeks afterwards when the pulsation was found to be diminished, and on a ray examination (*Fig 26*) the shadow of the sac was darker than before and very little pulsation was observed in it   The relative density of sac and wire was slight and the active clot must therefore have been only small in amount

He was readmitted on Feb 9, 1917, just a year later, saying that he went home sufficiently well to go back to work   In August, 1916, he was employed at Woolwich Arsenal sorting bullets— not an ideal occupation for a man with a large thoracic aneurysm   He worked there for two months, and was summarily dismissed when the Arsenal doctor discovered his condition   The diminution in the size of the aneurysm continued for some months, but in November, 1916, the swelling again began to get larger   The pain returned and his cough became more troublesome   He bore this for some months, but the pain and cough had become so much worse early in February that he came back to the hospital and asked to be readmitted for a further operation

Examination of the chest showed that the respiratory movements were good, and equal on the two sides   There was a swelling over the second, third and fourth ribs and costal cartilages

FIG 26 —Skiagram of *Case 2*, eleven weeks after operation   The arrows point to the ends of the wires forming the expanded wisp
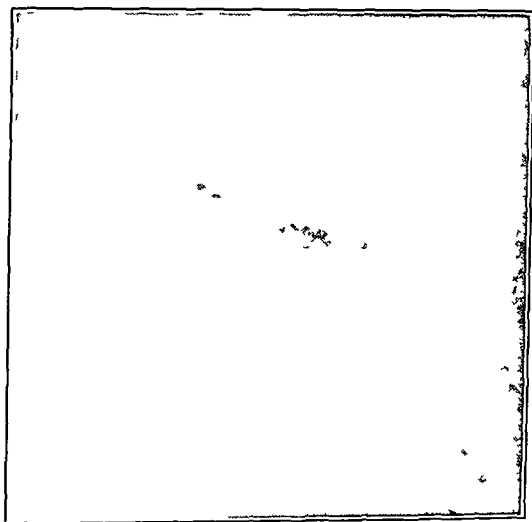
FIG 27 —*Case 2*, a year after operation

The swelling measured 2¼ in in breadth and 3 in in length   There was visible and expansile pulsation, and the percussion note over the tumour was dull   The tactile vibrations were diminished over the upper part of the right lung and the breath sounds in that region were weak   The percussion note was impaired below , the bronchial sounds were harsh, and there were some bronchitic sounds   There was also a slight tracheal tugging, and the voice was hoarse   The pulse was regular and of full volume , the tension was increased, and the left pulse was slightly weaker than the right   Shortly after admission the blood pressure in the right radial artery was 128 mm Hg and in the left 120 mm , after a rest in bed for twelve days the blood pressure was 105 on the right side and 115 on the left

An x ray picture (*Fig 27*) taken on Feb 13, showed a large aneurysm of the ascending arch of the aorta and a small bulge on the transverse portion of the arch   The wisp is clearly seen with the wires expanded, and the sac and its contents are much clearer than in the previous radiograph   The note states that the patient began to cough violently on Feb 19 and brought up a small quantity of bright blood   The aneurysm increased in size during his stay in the hospital until it reached the sixth rib, but there were no physical signs of pressure within the chest, except that the bronchial sounds were greater at the right than at the left apex of the lung

I again wired the aneurysm on May 2, using Colt s apparatus and introducing a No 2 wisp   The patient made an uneventful recovery, and was discharged on May 30 with the note, ' The pain is much less than before the operation and the pulsation in the swelling is less marked '   An x ray plate, taken on June 2, just shows the wires *in situ* (*Fig 28*), but it is not easy to determine the degree of expansion of the second wisp   The relative density of the sac and wire is much greater in this plate than in either of the two previous ones, and a considerable amount of clotting must therefore have taken place   The man only lived about a mile from the hospital and often came to report himself   He was able to do a little work as a night watchman until, on Aug 27, 1919

—forty two months after the first and twenty-seven months after the second wiring—he fell down in the street on his way home from work and died the same night   There was no post-mortem examination, as we did not hear of his death until some weeks afterwards   A fourth skiagram however, had been taken on Jan 30, 1918 (*Fig* 29), in which it is seen that the relative density of the sac and the wisps was not so great as it had been in June, 1917, which shows, perhaps, that the sac of an aneurysm fluctuates in size independently of any tendency to rupture
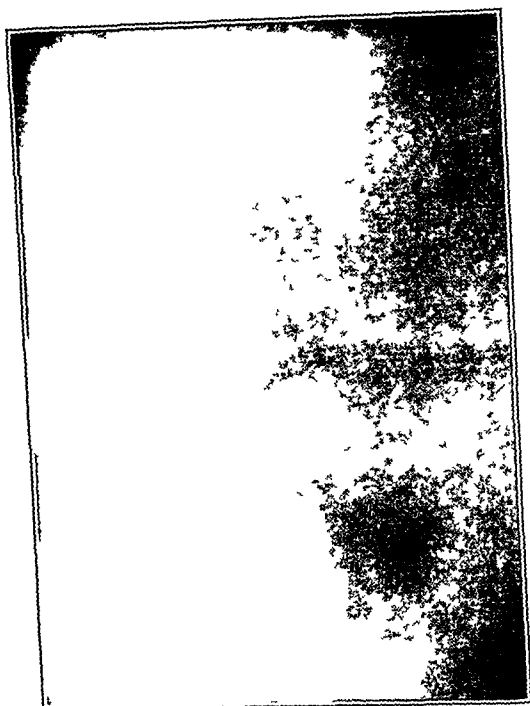
FIG 28 —*Case 2*, one month after second operation
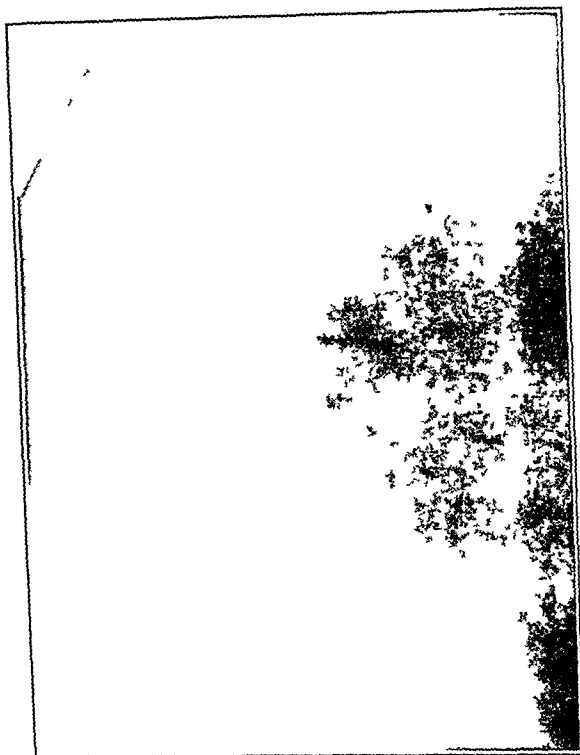
FIG 29 —*Case 2*, eight months after second operation

Case 3 —The third case was that of a married woman, aged 52, who was admitted into St Bartholomew's Hospital on March 25, 1919, complaining of a constant aching pain in her chest She said that she struck her breast accidentally about the beginning of December, 1918   The pain had been constant ever since and was now getting unbearable   It was throbbing in character Examination showed visible pulsation on the right side of the chest over the second interspace close to the sternum   The swelling was pulsatile   The chest-wall was so well covered that it was almost impossible to percuss out the heart   A diastolic and systolic murmur were heard at the apex   and there was a double aortic murmur   The Wassermann test was strongly positive

The patient was kept under observation in a medical ward from March 25 to April 24, 1919, and during the whole of this time she suffered much pain in her chest in spite of all that could be done to relieve her

On April 24 I wired the aneurysm under a general anæsthetic, using Colt's apparatus and introducing a No 2 wisp at the point of maximum pulsation   The patient made an uninterrupted recovery   and a note written on June 30, 1919, records that there was much less pulsation over the swelling and the pain was greatly diminished

The patient was readmitted to the hospital on June 8, 1920, saying that the pain had returned in November—five months after her discharge—and had again got gradually worse until she decided to apply for another operation   The blood pressure in her right radial artery at the time of her second admission was 165–160 mm Hg, and in the left radial 180–170 mm   There was no obvious tracheal tugging   Examination of the chest showed visible pulsation in the second right interspace, and the pulsation could be felt   There was also dullness over an area in the second right interspace close to the sternum   A double aortic murmur was heard at the base of the heart   and a diastolic murmur at the apex—systolic conducted (?) the note says   Both legs were ædematous, and the urine contained a trace of albumin

The patient was kept in bed from June 30 until July 5, when I again introduced a No 2 wisp by means of Colt's apparatus   The patient made a good recovery, and left the hospital on Aug 19,

the last note recording that the pain was much less than it had been before her admission   At the present time (March, 1921) the patient is living and doing her housework

My friend, Mr G E Gask, D S O , C M G , allows me to publish the following case which was under his care at St Bartholomew's Hospital —

*Case 4 —*C W , age 35, a cattle rancher, was admitted on Sept 19, 1919, complaining of continual pain in the small of his back, and periodic attacks of acute pain in the left hypochondrium   When the pain comes on in the left side he also feels a numb but burning sensation, and the skin becomes so sensitive that he cannot bear the weight of the bedclothes

One day in May, 1917, he was twice thrown from a mule and much shaken, but it was not until two months later that he began to feel pain in the small of the back   The pain was at first slight and intermittent, but it gradually increased and was constant   The patient states that he lost weight at this time and that he often had cramp in his stomach

He was admitted to a hospital in San Paulo in March, 1918, and was treated for rheumatism He was discharged some weeks later feeling quite well   He remained well for three months, when the pain returned in the back and left side of the abdomen   The cramp in his stomach became bad, and he lost 10 kilos in weight   He was treated by a Spanish doctor for 'nodular peritonitis' and was subcutaneously injected, probably with tuberculin   The patient again improved and gained 8 kilos in weight   The pain, however, returned, and he determined to come to England He arrived in September, having suffered severe pain during the last eight days of the voyage He was passing blood and mucus by the bowel and had lost 4 kilos in weight

Examination showed that the apex of the heart was in the fifth space internal to the nipple, and that the sounds were normal   The abdomen moved well , there was no distention, but the upper third of the abdominal wall was rather resistant   There was a slight swelling in the epigastric region 2½ in above the umbilicus and just to the left of the middle line   In this region there was a circular area about 2 in in diameter where pulsation and a slight thrill could be felt Expansibility could not be definitely made out, but there was dullness on percussion, and a systolic and diastolic bruit could be heard

At the back, about 1 in to the left side of the spine of the tenth dorsal vertebra, there was a small circular area of fullness about the size of a half crown which was expansile and pulsated A faint bruit could be heard over it   There was very great tenderness over the lower part of the abdomen, particularly on the left side, where the patient could not bear the pressure of the bedclothes

X-ray photographs showed more shadow than normal in the right upper abdomen, and the shadows of the intestines appeared to be pushed away from this part   There was no evidence of erosion of bone   The Wassermann test was strongly positive

A diagnosis was made of abdominal aneurysm, and on Oct 6 Mr Gask passed a No 4 cage into it by means of Colt's apparatus   The skin was cleaned with ether and picric acid, and a longitudinal incision was made through the skin at the level of the tenth dorsal vertebra and to the left of the middle line   The patient died suddenly from rupture of the aneurysm at 12 30 p m on Oct 15, nine days after the operation   He rallied well from the operation and said that he had experienced much relief from the pain which had previously been unbearable   The pulsation, however, remained unchanged and the femoral pulses were good

Subsequent examination of the body showed a large aneurysm of the abdominal aorta arising just below the pleural reflection   The primary opening of the sac was at the level of the first lumbar vertebra in the posterior wall of the aorta   The sac had expanded upwards into both sides of the thorax, pushing aside the diaphragm and the parietal pleura downwards on each side of the spine and posteriorly amongst the deep muscles of the back on the left side   The greater part of the aneurysm lay in the left pleura, and it had burst through a ragged and bruised looking opening just above the diaphragm   The sac had made its way amongst the deep muscles of the back and had eroded the last rib, which was fractured   Much of the sac contained laminated clot of old standing, but some more recent clot had formed round the strands of wire which had been introduced nine days before death   The cage of wire had expanded freely at both ends, but the recent clot did not extend to the ends of the wires which, during life, must have been bathed in fluid blood   There was no wire in the right half of the aneurysm where there was no clot None of the wires were near the seat of rupture   The specimen is preserved in the museum of St Bartholomew's Hospital, with the number 1551 F

More or less pain is a constant feature of all pathological aneurysms   When it occurs quite early in the disease and in deeply-seated arteries the cause is often overlooked or misinterpreted   Here is an example which came under my notice a few years ago —

*Case 5 —*A lady, age 46, complained of pain in the chest, loss of appetite, flatulence, discomfort after meals and constipation   The pain was referred to the lower half of the sternum going through to the left scapula   It was worse after food, and sometimes prevented her taking a deep breath   These symptoms were prominent throughout her illness, though they varied in intensity She said that she had always suffered from a weak digestion, and to cure her 'dyspepsia' she was

in the habit of taking long walks—preferably uphill—and of bicycling Her condition remained without material change from February, 1907, until August, 1910, during which time she took aspirin and bromides to relieve the pain A physical examination of the chest in August, 1910, revealed a soft systolic murmur over the aortic valves, and at this time she was complaining of pain extending to the left shoulder and down the left arm In January, 1911, pulsation was visible in the second left intercostal space near the sternum, and she had a cough with expectoration of mucus which was occasionally blood stained The pain still continued, and was increased by the act of swallowing A skiagram taken eighteen months later showed a sacculated aneurysm which contained a considerable quantity of clot and sprang from the descending portion of the arch of the aorta The patient was then kept in bed, but in spite of rest, a low diet, and large doses of potassium iodide, the aneurysm increased in size, while the pain became more severe and was felt in the left axilla Four months later the second, third, and fourth ribs on the left side, with the corresponding costochondral articulations, had become eroded The aneurysm was wired on March 25, 1913, and she left the nursing home on April 19, twenty-five days after the operation, with pulsation in the aneurysm almost imperceptible and the pain greatly diminished She lived until the aneurysm ruptured on July 26, the pulsation remaining imperceptible from April to July, and with only occasional attacks of pain which she said were quite bearable

I was fortunate enough to obtain a post mortem examination of the body, and the specimen is preserved in the museum of St Bartholomew's Hospital (No 1551E) with the following description —

' A section through a large aneurysm of the third part of the arch of the aorta which had been treated four months previously by gilt wires inserted by means of a Colt's apparatus The aneurysm springs from the left side of the descending aorta at its junction with the aortic arch, it has eroded the second, third, and fourth left ribs and costochondral joints, and passes through an aperture in the chest-wall fully 3 in in diameter The aneurysmal sac measures 5 in in diameter and is more than two-thirds filled with firm laminated clot, embedded in which is a network of gilt wires The laminated clot is from 2½ in to 3 in in thickness, and the double wisp, which has expanded freely, is embedded along its inner aspect "

It is clear, therefore, that the bulk of the laminated clot has been formed since the introduction of the wisp, or the wires could not have expanded Some of the free ends of the wires lie in recent clot This recent clot is ¾ in in thickness and is situated in that part of the sac lying outside the chest wall The rupture has taken place as a small slit which allowed the blood to pass into the left pleura The aneurysm lying inside the chest is cured, that lying external to the chest wall, and which is of the size of a man's fist, still remains

This case well illustrates the character of the pain in aneurysm It is slight and badly localized in the early stages, but it is constant and tends to get worse, in the later stages it often becomes so severe as to render the patient's life intolerable The less the clotting in the sac, the greater appears to be the pain in the earlier stages of the disease It may be caused, therefore, by the distention of the inflamed wall of the artery If this be the case the good results following the wiring of an aneurysm are easily explained A clot is formed round the wires, the pulsation is diminished, and the pain is lessened because the arterial wall is at rest

The severe pain of the later stages is felt when the aneurysm is brought into relation with resisting structures which are either absorbed or inflamed by the intermittent pressure It is usual, therefore, to have severe pain in thoracic aneurysms where the ribs and costal cartilages are being eroded, and in the descending aorta when the vertebral column is involved I have seen it in subclavian, and less frequently in popliteal, aneurysms, but carotid aneurysms and aneurysms of the coeliac axis may attain a large size without much pain Even in these, however, no rule can be laid down, as is shown by the following cases

In February, 1912, Sir W I de C Wheeler showed 2 cases of aneurysm in the coeliac-axis region [1] Colt's instruments were used in both cases A cage of 150 in of gilded wire was introduced in the first case and a wisp of 105 in in the second The prominent symptoms before operation were intense pain in the back, marked epigastric pulsation, and digestive disturbances A systolic murmur could easily be heard over the tumour Sir William Wheeler considered that the pain in the back, which was severe enough to require morphia before operation, was more likely due to stretching and heaving of the peritoneum of the posterior abdominal wall than to erosion of the vertebræ He also wired a third case of abdominal aneurysm, introducing 150 in of wire and performing a gastro enterostomy at the same time The patient shortly afterwards developed symptoms of intestinal obstruction, and on re opening the abdomen a loop of jejunum was

found compressed between the tumour formed by the aneurysm and the stomach and abdominal wall   The obstruction was relieved, but the vomiting continued to a less extent, and the patient died in a week from rupture of the aneurysm at a point remote from where the wire was introduced   At the post mortem examination the wisp of wire was found situated between the layers of laminated clot—formed before operation—and had not expanded to any extent   The aneurysm extended from just below the cœliac axis to the level of the inferior mesenteric artery   An opening about the size of a shilling was found between the anterior wall of the aorta and the sac of the aneurysm   This opening was almost occluded by a valvular arrangement of laminated clot within the sac

Sir William Wheeler commented upon the intense pain in the back suffered by this and two other patients upon whom he had operated   There was no erosion of the vertebræ in this case, and Sir William Wheeler suggested that the pain in the back, which is so constant a feature of this form of aneurysm, might be due to the stretching plus the heaving of the posterior parietal peritoneum   Stretching alone would not necessarily account for the pain   In each of the three cases the pulsation and pain in the back were more violent for a few days after the operation than they had been previously, but they then improved rapidly and the pain completely disappeared

Of the two cases which survived, one was shown five years later [2]   The man had worked hard and continuously at his original employment in Guinness's brewery   He was free from symptoms   but a pulsating swelling could still be felt in his abdomen   There was no bruit to be heard over it, and the pulsation was no longer expansile   It may be assumed, therefore, that the aneurysm is cured   Sir William Wheeler tells me (February, 1921) that the man is still alive and at work in his usual situation, and that it is now eleven years and a half since the aneurysm was wired

In the second case [7] the patient was passed as sound for service in the Naval Reserve, and during the war acted as stoker on a patrol trawler   He died of leakage from a secondary dilatation of the aorta below the aneurysm 4 years and 8 months after the operation   The aneurysm itself was about the size of a full term fœtal head, and was apparently completely consolidated   The wires had expanded evenly

Lieut.-Colonel C B Lawson, R A M C, wired an aneurysm as large as a Tangerine orange springing from the aorta between the cœliac axis and the superior mesenteric artery   The operation was performed on May 6, 1906, the man's age being 33   He died on Nov 26, 1916, and was able to perform his duties in the interval   The earlier details of the case are recorded in the Proceedings of the Royal Society of Medicine

Mr R C B Maunsell, of Dublin, wired an abdominal aneurysm in a woman age 30, who lived a year after the operation   She was then readmitted to hospital suffering from acute abdominal pain   Next day she died very rapidly with symptoms of internal hæmorrhage   No post-mortem examination could be obtained   Mr Maunsell writes " This woman never gave herself a chance of permanent cure, as she drank heavily   The abdominal tumour never disappeared, but after the operation it remained firm, and I could not satisfy myself that there was expansile pulsation '

The severe pain in the later stages of some forms of aneurysm, therefore, is due to the effect of the pulsatile swelling on rigid structures, and if the pulsation be stopped the pain is relieved

The effect of wiring in relieving pain in cases of thoracic aneurysm is greater in thin-walled aneurysms than in those which already contain much clot, and the relief follows quickly upon the operation   The introduction of the wire results in extensive coagulation of the blood in the sac the clot being of the passive variety, that is to say, it is like ordinary blood-clot and is not laminated   A soft and elastic buffer is introduced, therefore, between the pulsating blood-stream and the inflamed and painful structures which have been previously pressed upon intermittently   Presently some of the clot becomes organized and the sac-wall becomes thickened, so that if the patient lives long enough, and the aneurysm is well sacculated, with only a small communication between it and the vessel from which it rises, an actual cure may take place   Unfortunately however, it is only too often a cure of the aneurysm and not a cure of the patient   The inflammatory

processes in the artery which led originally to the formation of the aneurysm continue in other or neighbouring parts   Another aneurysm is formed, or rupture takes place and the patient dies   Still, a few cures have resulted and many patients have been relieved of pain, so that the method is well worthy of more extended application, the more so as the operation is simple and is not attended with excessive danger   I do not see any advantage in combining electrolysis with wiring   It prolongs the operation, it introduces additional factors of danger, and it does not alter the physiological effect of the treatment, which is to obtain clotting within the sac   Admittedly the chief effect of it is to *initiate* the process of clotting, and this we now know is done quickly by the granular surface of the dull-gilt wisp   I have therefore never employed electrolysis, for it has always seemed to me to be reminiscent of a time when little was known of the physiological processes connected with the clotting of blood and too much was expected of electrical treatment

DURATION OF AORTIC AND ABDOMINAL ANEURYSMS

To enable an idea to be formed of the value of operation in cases of thoracic and abdominal aneurysm, Mr Colt has investigated the notes of all the fatal cases which occurred in St Bartholomew's Hospital during the thirty-six years 1871–1907 inclusive, and has included twenty-two cases given by Nunneley[4] and two by Sir William Osler [5] In the 179 cases collected by Nixon[6] the duration of the disease is only mentioned in one case, and this is included in the present list   The numbers are those of patients whose records are sufficiently explicit to allow an estimate to be made of the length of time which intervened between the first complaint of symptoms and death—no operation having been performed   They are too small to warrant an average, and the median duration of the disease, therefore, has been taken instead   The Registrar-General is unfortunately unable to furnish any data compiled from death certificates   Such data in this and other diseases would be of great value in determining prognosis, and would aid the assessment of the value of operation in any particular case   The table of male cases is as follows —

SITE OF ANEURYSM	MEDIAN AGE	MEDIAN DURATION OF SYMPTOMS	NUMBER OF CASES ANALYZED
Ascending arch	44	15 months (max 4 years 4 months)	34
Ascending and transverse arch	46	9 months (max 1 year 9 months)	16
Transverse arch	39	7½ months (max 3 years 1 month)	24
Transverse and descending arch		Number of cases insufficient to generalize	
Descending arch	49	15 months (max 3 years 3 months)	11
Descending aorta	39	10½ months (max 6 years)	6
Abdominal aorta	36	10 months (max 3¼ years)	42

° An exceptional case in which the disease lasted at least eight years has been omitted

Aneurysm is much less common in women than in men   Of five cases in which the *ascending* portion of the arch of the aorta was affected, the mean age was 42½ years , the mean duration was 25 months, the maximum being 54 months   In three cases where the *transverse* portion of the arch was involved, the mean duration was 21 months and the average age 46 years   The longer duration of symptoms in women suffering from aneurysm of the transverse part of the arch may, of course, be due to the small number of the cases but is the pressure symptoms are greatly aggravated when consolidation occurs in this portion of the arch, operation is clearly out of the question

I have purposely headed this paper, " The Palliative Treatment of Aneurysm by Wiring,' because I do not wish to raise vain hopes about the treatment of a deadly disease   I know quite well that relief from pain is often secured by rest in bed for a prolonged period of time on a low diet with restriction of fluids and the administration of large doses of iodide of potassium   In the cases which have been given in this article, these methods had been tried by competent persons under the best possible conditions of nursing, and had failed   In nearly all the cases the pain was relieved by wiring, and two of the patients returned voluntarily and asked for a second operation   In some of the recorded cases an actual cure of the aneurysm seems to have followed the introduction of the wire, but in spite of the figures which Mr Colt has been good enough to supply, we do not yet know enough about the natural history of the disease to say whether this great prolongation of life was in consequence of the operation or whether it would have occurred spontaneously   This will form the subject of a future investigation

The following is a summary of all cases up to March, 1921, treated by Colt s apparatus, without electrolysis —

1 Male —Ascending arch , right carotid and subclavian tied two years previously   sac bulging externally   Died seven days after operation from external hæmorrhage —*Unpublished*
2 Female —Descending arch   Died four months after operation from rupture of sac —*Power*
3 Male —Ascending and transverse arch   Died eleven days after operation from dyspnœa —*Power*
4 Male —Ascending arch   Died three and a half years after first and two and a quarter years after second operation, probably from rupture of sac —*Power*
5 Female —Ascending arch   Alive and well two years after first and eight months after second operation —*Power*
6 Male —Abdominal   Died two days after operation from ether pneumonia —*Holt*
7 Male —Abdominal   Died four days after operation from rupture of sac —*Power*
8 Male —Abdominal   Died two months after operation from leakage of sac —*Unpublished.* No further particulars could be obtained   Died of pneumonia some months after operation   The cage had not expanded —*Braine Hartnell and Collins*
9 Male —Abdominal (partly dissecting)   Died six days after operation   The cage had not expanded —*Braine Hartnell and Collins*
10 Male —Abdominal (partly dissecting)   Died of pneumonia some months after operation —*Prof Conway Dwyer*
11 Male —Abdominal, causing pyloric obstruction , gastro enterostomy   Died of rupture of sac seven days after wiring —*Wheeler*
12 Male —Abdominal   Alive and well eleven and a half years after operation —*Wheeler*
13 Male —Abdominal   Died four years eight months after operation from leakage of secondary dilatation   Aneurysm apparently cured —*Wheeler*
14 Male —Abdominal   Died nine days after operation from rupture of sac —*Gash*   No details ascertained —*Lawson*
15 Male —Abdominal   Died ten and a half years after operation, probably from rupture of sac —*Lawson*
16 Female —Abdominal   Died one year after operation, probably from rupture of sac —*Maunsell*

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OBSERVATIONS ON FIFTY CASES OF HOUR-GLASS STOMACH SUBJECTED TO OPERATION.*

By W THELWALL THOMAS, Liverpool

In studying the notes of fifty consecutive cases of hour-glass deformity of the stomach (bilocular stomach) surgically dealt with, many points of interest seem worthy of record

1 **Sex Incidence**—The rarity in the male—only 4 cases occurring in men, 46 in women

2 **Symptoms**—In 8 cases a long history of gastric pain, in 28 cases a long history of pain and vomiting, in 14 cases a long history of pain, vomiting, and hæmatemesis—only in 3 cases, however, was the bleeding at all severe, but one had suffered from five attacks of gastric hæmorrhage, while in the others merely a trace of blood had appeared on rare occasions   Four had been operated upon for perforated gastric ulcer

The most noticeable feature was the long duration of symptoms before surgical aid had been resorted to—with the exception of 3 patients, whose symptoms had only lasted one, two, and three years respectively   All the others had complained of gastric trouble for periods varying from five to thirty years, taking an average, it worked out at nine years, and most of the sufferers had been under medical treatment intermittently throughout

3 In no single patient had malignant disease supervened, which, although suspected in two cases, was disproved on operation

4 It had not been possible in a single case definitely to diagnose bilocular stomach by ordinary methods, radiography being essential

5 Two cases (in addition to the 4 perforated ulcers) had been previously operated upon—1 by gastroplasty and 1 by posterior gastro-enterostomy—though another one had had the gall-bladder drained (no stone found), the symptoms having suggested biliary colic

From this series of cases it appears that the acute-hæmorrhage variety of gastric ulcer rarely leads to this deformity—but rather the chronic ulcer on the lesser curve with many years history of a continuous or intermittent type   Many ulcers had completely healed, leaving a hard scar which in process of years had drawn to itself the adjacent areas of gastric wall so as to produce the contraction   Many had unhealed ulcers—some with extensive adhesions to liver, pancreas, and even to the anterior abdominal wall—while others had a fold of great omentum caught up to the lesser curvature, suggestive of old partial perforation   In view of the current opinion that malignant disease of the stomach is grafted on a chronic ulcer foundation, this series of fifty without a single malignant case does not support it, although the symptoms had lasted twenty and even thirty years in some of the patients

Radiographic examination is essential to elucidate the condition, all other methods having failed   and the valuable reports in each of the cases by my friend and colleague, Mr Thurstan Holland, revealed many important points   His reports and photographs in seven of the cases demonstrated pyloric stenosis in addition   His observations on the activity or otherwise of the muscular walls, and the relative sizes of the two sacs, were of great value   It was noticeable, however, probably owing to the weight of the barium meal in the lower pouch, that the area of constriction seemed to be much longer than that

found subsequently on operation, with the stomach washed out and the patient of course lying down, and this drag or prolapse, rather tended to mislead as to the position of the upper sac This must be realized, and great care taken to explore thoroughly as far as the actual cardiac orifice   Gastro enterostomy has been performed on the wrong pouch owing to this neglect

It cannot be too strongly emphasized that the only accurate means of diagnosis is by radiographic examination and report thereon by an expert, lest spasmodic contractions, which are very common, should be mistaken for the cicatricial variety   If this means of investigation had been resorted to many years earlier in most of my cases, the patients would have been relieved of much suffering, by resorting to surgical means earlier   for many of them were very emaciated, some to an extreme degree, suggesting malignant disease to their friends and medical attendants

Surgical intervention is the only possible means of cure and there is no condition in surgery that may call for so great a variety of procedures to deal with the degrees and complications met with, and although the radiographic evidence affords valuable help, it is impossible in any given case to have the slightest idea beforehand what surgical manœuvre will be resorted to

The whole stomach, from the cardiac orifice to the pylorus, front and back, must be carefully examined, and the merits and possibilities of all known (and even unknown) described operations quickly considered, before deciding what course to pursue

It is highly important in many of these semi-starved patients to use every known means to increase resistance and prevent shock   Rectal salines with glucose for a day or two before operation subcutaneous salines, Crile's local anæsthesia, and open ether during operation on a well-warmed table will, with care and well-studied rapidity, bring many a patient through an anxious, bad surgical risk
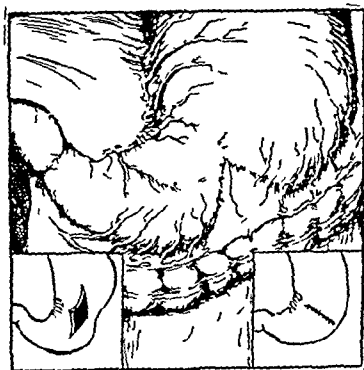
FIG 30
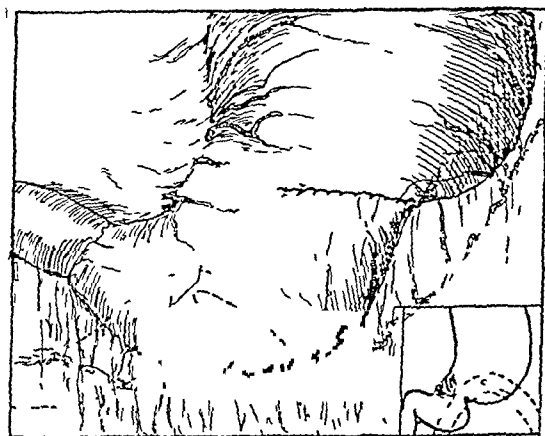
FIG 31

In this series the following procedures have been carried out —

1 When the pouches have been large, with a fairly wide waist between, with much active muscular wall, gastroplasty was chosen in 6 cases—also in a seventh, but combined with a posterior gastro enterostomy to the distal pouch on account of pyloric cicatrization (*Figs* 30 and 31)

2 When the pouches were large the constriction narrow and fibrous and in several with extensive adhesions to the liver, gastro-gastrostomy proved satisfactory in 15 cases (*Fig* 32)

3 Posterior gastro enterostomy performed on the proximal pouch suggested itself in 14 cases—in 2 of these the union was made opposite the ulceration but extending well into both pouches when the proximal sac was small and high up (*Fig* 31, inset)

4 Where the pouches were about equal in size and the constriction extensive, with pyloric stenosis in addition, double posterior gastro-enterostomy was resorted to in 2 cases (*Fig* 33)

5 In 3 cases complicated by extensive adhesions in the lesser sac of the peritoneum to the pancreas, a retrocolic anterior gastro-enterostomy was possible (*Fig* 34)
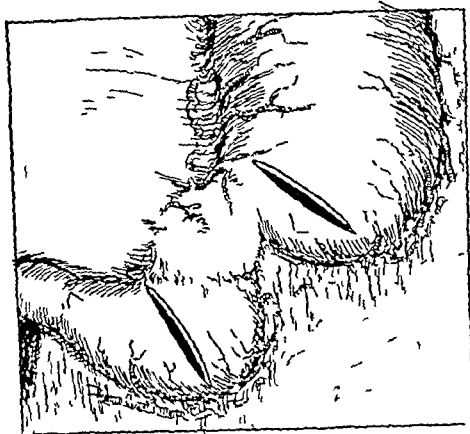
Fig 32

Fig 33

6 In 3 of the patients each having a very small proximal pouch, with the lesser curve adherent to the liver, an anterior gastro enterostomy seemed essential and in one of these, the intestinal loop being long, an entero-enterostomy was added (*Fig* 35)

7 In one very difficult recent case an extensive area at the constriction was adherent to the anterior abdominal wall at the level of the umbilicus, the stomach being much proptosed and acutely kinked, leaving only a small piece of available stomach in the front of the proximal pouch It seemed inadvisable to separate the stomach from the abdominal wall, it being almost certain that if this were attempted the stomach would be extensively
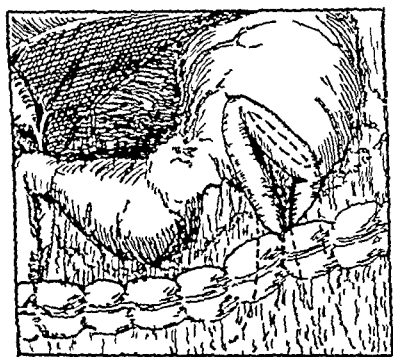
Fig 34
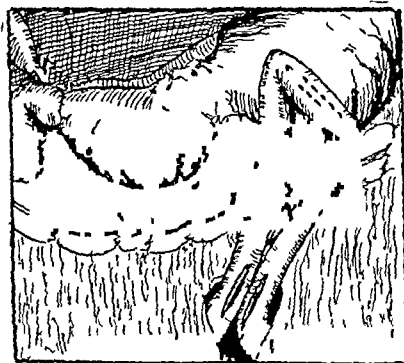
Fig 35

opened and thus increase our difficulties and the risk to a patient extremely ill and emaciated We were able to mobilize the second part of the duodenum, and perform a gastroduodenostomy between the proximal pouch and the duodenum *above* the area adherent to the abdominal wall (*Fig* 36)

8 In another complicated condition, the lesser curve was intimately incorporated with the liver, the proximal pouch small and adherent posteriorly, while the front of the distal sac had hardly any portion not adherent to the liver, pyloric stenosis was present in addition This looked for the moment an impossible problem to solve, but thanks to a retrocolic anterior gastro-enterostomy to the proximal, and a posterior gastro enterostomy to the distal pouch, we were carried safely through (*Fig* 37)

9 The last two cases of the series necessitated partial gastrectomy —

a The constriction was excised the distal part of the stomach closed, and the small intestine sutured to the end of the proximal pouch, the bowel loop being brought through the mesocolon (*Figs* 38, 39)

b In this case a very large distal pouch hung in the pelvis, the constricting ring being narrow (although the radiograph showed it some inches long)   There were pyloric stenosis and some thickenings in the distal pouch suggestive of ulcerations   The lower

FIG 36
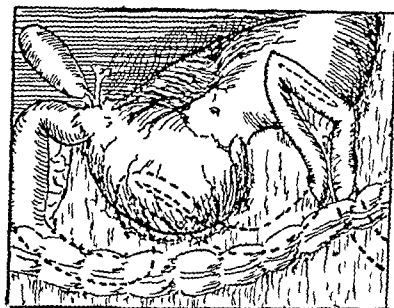
FIG 37

pouch was removed along with the constriction, and the proximal pouch dealt with as in the previous case   The specimen removed exhibited six ulcers

I know of no condition that can provide the surgeon with such an intricate and interesting problem as an hour-glass stomach, and its solution is only possible after opening the abdomen   In spite of all our efforts to improve the condition of the patient before operation and the care taken on the operating table to avoid shock, 7 deaths are to be recorded in this series, namely   3 following posterior gastro enterostomy (two women, one man) , 2 following gastro gastrostomy (one three weeks later from pneumonia
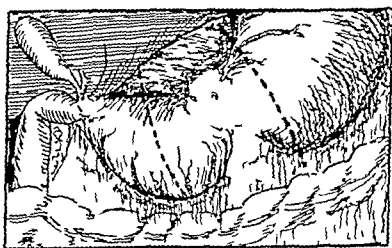
FIG 38
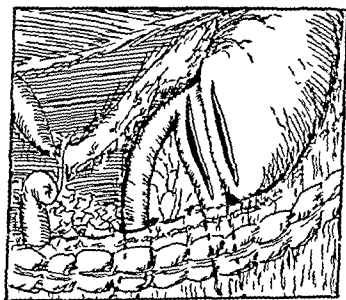
FIG 39

and empyema)   1 following retrocolic anterior gastro enterostomy in a male , and 1 following partial gastrectomy, also in a male

Three of the patients succumbed to bronchopneumonia in a few days, and one died suddenly from pulmonary embolism on the fourteenth day   One gastrectomy case died suddenly next day and two others simply from lack of recuperative power

Ether was administered by the open method in all cases by a skilled anæsthetist

The mortality-rate may appear high   but what mostly impressed us was the astonishing recovery in a great many almost hopeless cases in persons reduced to extreme emaciation through long years of suffering   It is hoped that, in future, much earlier resort will be made to radiographic investigation in vague cases of chronic indigestion that do not readily yield to medicinal and dietetic treatment

With such a variety of operations necessary to deal with this condition, it was interesting to ascertain the end-result to the patient. Mr R Kennon kindly undertook this for me, and through his assiduity I am able to report on all but three of the cases. It does not appear that any particular type of operation had much to do with the final result, provided a free flow had been established from the stomach

Only 6 have complained of gastric symptoms since operation. 1 operated upon five years ago has 'some vomiting', 1 operated upon three years complains of 'vomiting', 2 have some indigestion, 1 had a severe attack of hæmatemesis one year after operation, and was subsequently radiographed, but she has now been well for four years. Four have died from diseases unconnected with stomach trouble

All the others send expressions of thanks and gratitude, and the most frequent answers have been, 'eat anything 'quite well', 'very good health', and one who had suffered severe pain for many years alludes to the operation as 'a miracle

A CASE OF HOUR-GLASS STOMACH

By G A EWART, London

The following case seems to be worthy of record from the fact that it is a good example of a somewhat rare condition, and also has the added interest of extending over a period of more than twenty years, being almost historical in a surgical sense   Further, it perhaps throws some light on the treatment of conditions with which the abdominal surgeon is sometimes confronted

In the year 1897 the patient, then a girl, age 22, was subject to attacks of severe abdominal pain, indigestion vomiting, and hæmatemesis   These symptoms may be said to have reached a climax in 1900, when the patient was seized with acute abdominal pain, and the diagnosis of perforation of a gastric ulcer was made   This occurred in Egypt and though no surgical measures were adopted, the patient made a slow recovery   She returned to this country and towards the end of 1900, as pain and vomiting persisted, she was seen by Sir Arthur Mayo Robson, who, after investigation, made the diagnosis of hour-glass stomach   In November, 1900, an operation was performed in Leeds Infirmary, and a posterior gastrojejunostomy was done to the proximal pouch of the stomach with the aid of the operator's bobbin   An account of the operation may be found in *Diseases of the Stomach and their Surgical Treatment*, by Mayo Robson and Moynihan, and may be quoted

' Miss D B , age 25, was admitted to the General Infirmary, Nov 5, 1900, with a history of stomach symptoms for three years, with pain and vomiting   During part of the time, she had been in hospital and under thorough medical treatment, but without material benefit, except of a temporary character

' OPERATION, Nov 15, 1900 —A large constriction was found in the centre of the stomach, forming a characteristic example of hour-glass contraction, both cavities being dilated, the proximal being larger than the distal cavity   Numerous adhesions had to be separated, especially around the pylorus, and others between the stomach and colon   A posterior gastro enterostomy was performed, from which the patient made an uninterrupted recovery   she returned home on Dec 11   On April 9, 1901, she returned to the Infirmary, having had some recurrence of pain and vomiting , but under rest and careful dieting the symptoms completely passed off in three weeks, and she was sent home weighing 7 lb more than she did when in hospital on the former occasion   During the three weeks the patient was under observation she had no sickness, and during the latter part of the time was able to take ordinary food without discomfort "

This improvement was maintained for some time, but gradually the patient's condition became worse, pain without vomiting being chiefly complained of, until, in the year 1913, the appendix was removed by another surgeon, as it was supposed to be responsible for a certain degree of mucous colitis which was present   No improvement of the condition followed this operation

The above gives a summary of the case until the time when I first saw the patient at the end of 1920   Previous to this the patient had been in hospital for some two months, under strict medical treatment, without deriving any marked benefit, the chief complaint being of pain, even after fluid diet , the pain was localized to a spot situated about midway between the ensiform and the umbilicus   Vomiting was only occasional   Some six months previously there had been slight hæmatemesis   On examination the patient was noticed to be rather wasted , firmly healed scars were present in the appendix region and over the right upper rectus segment   On palpation of the abdomen some tenderness without rigidity was noted in the epigastric region, but no mass could be felt   Investigations

were next made by means of a bismuth meal and x rays Fig 40 shows what was found , that is, an hour-glass stomach with a large proximal and a small distal pouch about the size of a golf-ball, with a very attenuated passage leading from one to the other It may be further noted in the picture, which was taken fifteen minutes after the meal, that already a small quantity of the bismuth shows in the upper coils of the jejunum proving that there was no marked pyloric stenosis Further x-ray examination showed that there was very marked delay in the complete emptying of the proximal stomach pouch No sign whatever could be seen of the functioning of the previously performed gastrojejunostomy

Under these conditions, a further laparotomy was decided upon The abdomen was
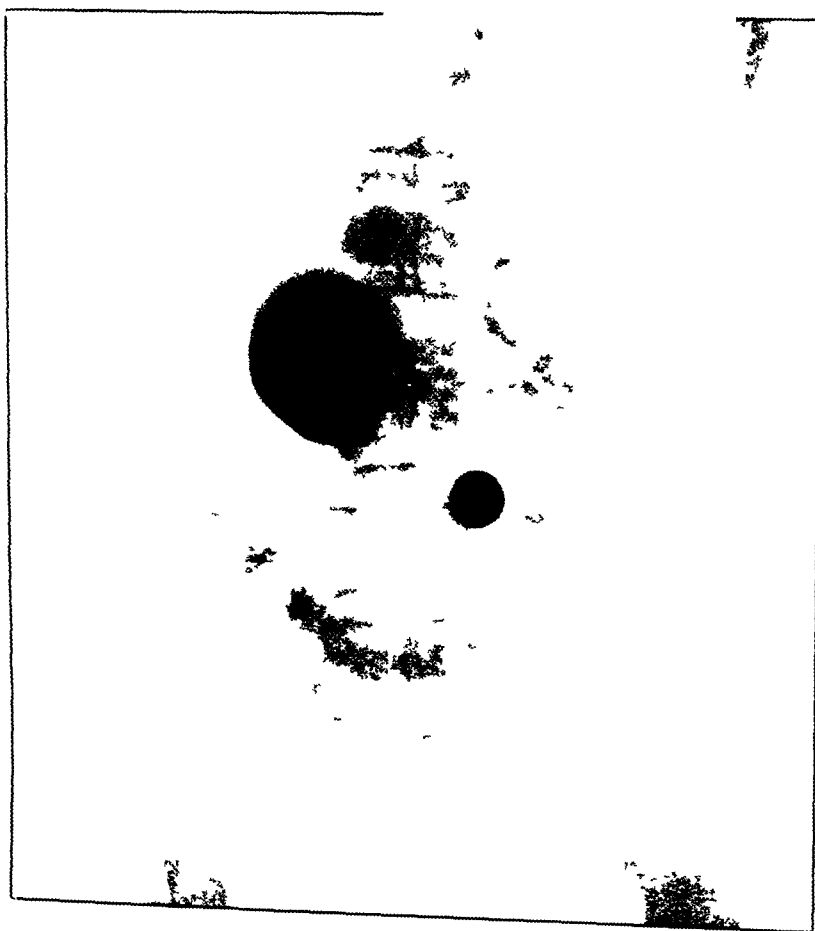
Fig 40 —Skiagram showing the condition before operation

opened through the left upper rectus segment on Jan 30, 1920 After dividing many adhesions, it was found that the stomach was encircled by a dense fibrous ring more than an inch in breadth, some two inches proximal to the pylorus This ring-like structure was adherent posteriorly to the pancreas, and above to the under surface of the liver The stricture was so dense that it was difficult to form an accurate opinion of the size of the passage between the two pouches of the stomach, but it was estimated to be about the size of a No 10 catheter On examination the pylorus showed no signs of stenosis , there were however some surrounding adhesions to the under surface of the liver On turning up the transverse colon, the jejunum was found to be adherent to the transverse meso-colon at the site of the previous gastrojejunostomy Much matting of the intestines made the procedure difficult but eventually the efferent loop of the jejunum was isolated This

was traced up to the previous seat of the anastomosis, and the junction carefully palpated No stoma between the stomach and the intestine could be felt The next question was what was the best procedure to adopt Obviously any anastomosis between the proximal and the distal pouches of the stomach (gastrogastrostomy) was out of the question, the distal pouch being too small to allow of any satisfactory channel being established Gastroplasty, on account of the breadth and density of the stricture, was also impossible One alternative was to undo the old gastrojejunostomy, and re-establish the opening in the site of the previous anastomosis This would have been very difficult to accomplish on account of the dense adhesions and almost complete obliteration of the lesser sac of peritoneum
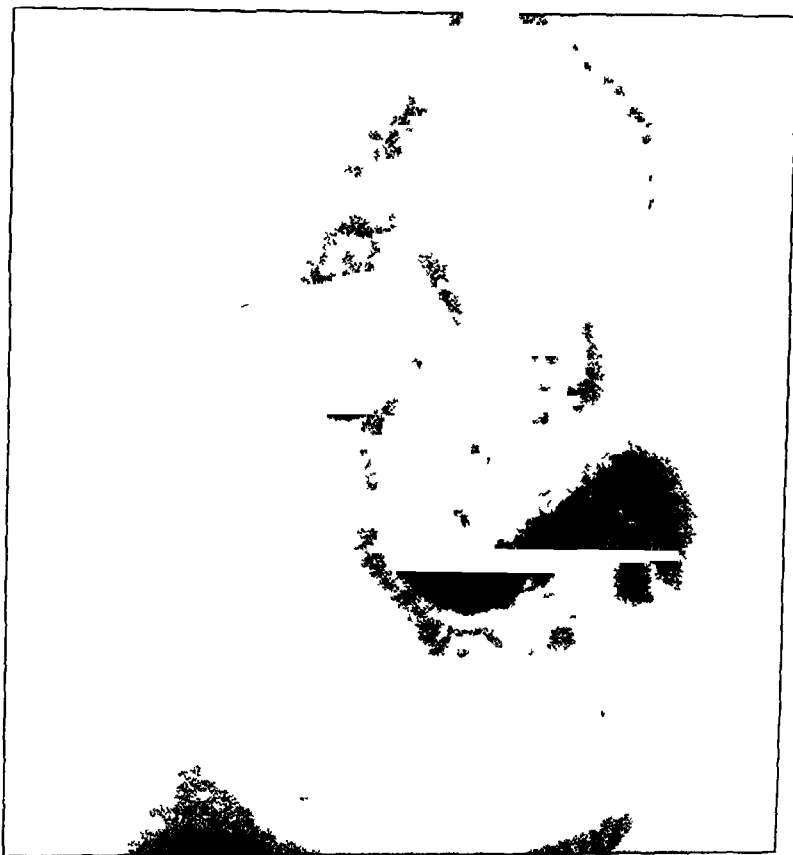
FIG II —Skia-ram taken in the erect position during expiration ten minutes after a bismuth meal

The only other alternative seemed to be to do some form of anterior gastrojejunostomy to the proximal pouch On consultation with my colleague, Sir Crisp English, who happened to be watching the operation, I determined to do an anterior retrocolic gastro-jejunostomy, as first carried out by Mr Sherren (Choyce s *System of Surgery*, vol ii) This seemed a better plan than bringing the jejunum across the transverse colon, which involved the risk that the transverse colon might be caught up in the adhesions which had been divided, and perhaps cause trouble at a later date An opening was therefore made through the transverse mesocolon just to the right of the old anastomosis Through this opening, the jejunum was brought into the lesser sac, and then, by incising the gastro-colic omentum, the coil of gut was brought forward to the anterior aspect of the proximal pouch of the stomach Here a gastrojejunostomy was performed after the usual manner,

silk sutures being used throughout   Care was taken to keep the new stoma as near the stricture as possible, to prevent any S-shaped kinking of the gut between its two fixed points   After the completion of the anastomosis, the jejunum was opened just beyond the new stoma to investigate better the lie of the gut, and incidentally the seat of the previous operation   It was found that the new opening was about two inches in length from this point the finger passed backwards and somewhat to the left, and came to the seat of the old opening, without any intervening loop   No sign of the original stoma between the stomach and jejunum remained, some scar tissue alone indicating its position   The opening made in the jejunum for this investigation was next closed with two layers of continuous silk suture   First changing gloves and instruments, the abdomen was closed in layers   After the operation, a fear was entertained that the kinking entailed by bringing the jejunum from the posterior to the anterior aspect of the stomach might prove prejudicial   These fears, however, proved groundless, and the patient made an uninterrupted recovery   She was seen just a year after the operation, when the second radiograph (*Fig* 41) was taken   This shows a bismuth meal ten minutes after ingestion the patient being in the erect position   The large proximal and small distal pouches of the hour glass stomach can still be seen, the distal pouch being, if anything, a little contracted   The functioning of the new anterior retrocolic gastrojejunostomy shows extremely well, a large quantity of the opaque meal having already passed through the stoma at the short interval of ten minutes after ingestion

With regard to the patient, she can hardly be recognized as the same individual Since operation she has lost all her pain, and is now able to tolerate ordinary diet without discomfort   During the past year she has increased 22 lb in weight, almost 2 lb a month, and is now able to carry on her occupation   All pain and tendency to 'colitis' have been lost, and, generally, the condition of well-being of the patient may be summarized in her statement that she " does not know herself '   The question arises as to whether this improvement is likely to be permanent   Personally, I think there is little possibility of the new stoma closing, the degree of stenosis between the two pouches being such that it must be much easier for food to pass along the new channel than find its way painfully into the distal pouch of the stomach   Probably when the first operation was done the circular ulcer was not fully cicatrized, and the lumen between the two pouches was much larger

The above case seems of interest inasmuch as it gives an indication as to the line of treatment in cases where a gastrojejunostomy, though still needed has for some reason ceased to function   Any surgeon who has had either to undo, or re-fashion a gastrojejunostomy, has doubtless been confronted with adhesions which have proved a great difficulty

This case shows that a satisfactory result can be obtained by an anterior retrocolic gastrojejunostomy, even though the jejunum proximal to the anastomosis is anchored to the posterior aspect of the stomach, which necessitates a certain amount of angulation in bringing forward the intestine

INTUSSUSCEPTION
A MONOGRAPH BASED ON 400 CASES

By W S PERRIN London, and E C LINDSAY, London

THE material for this investigation has been collected from the London Hospital records of the cases of acute intussusception admitted during the eighteen years from 1903 to 1920 inclusive Only the first seven cases admitted during 1920 have been included, in order to bring the total number up to a level 400   Otherwise, with few exceptions, every case admitted during the eighteen years surveyed has found a place among the 400

It is obvious, in compiling statistics with reference to any one point, that information will not always be forthcoming from each of the 400   Thus, while in every one of the cases it has been possible to ascertain the age of the patient and the month of the year in which he or she was admitted, in only 341 is the type of intussusception described   On the whole, however, fairly full data have been available in almost every instance   Thus, in the majority of the notes the length of the history is given, and by searching the records of the operating theatres it has been possible to ascertain the time occupied by each surgeon in performing the operation, while in many cases which have died, reports of the post-mortems have been available and have yielded valuable information   The series is a consecutive one, though a few cases have been excluded on account of the poverty of the notes, and the operating-theatre registers reveal the existence of several cases the notes of which cannot be traced

There are records also of 19 cases of intussusception during the eighteen years surveyed which we considered either to come under the heading of the chronic variety of intussusception or to have too doubtful a history to be definitely included among the acute   They have therefore been excluded from the series, which deals with the acute form only

In theory it is difficult to define exactly the dividing line between an acute and a chronic intussusception, but in practice the two varieties are rather sharply distinguished from each other   For example, the longest history in our series of acute intussusceptions is ten days   The patient was a youth, age 20, and at operation the gut was gangrenous This is a fairly long history for an acute intussusception, and is to be accounted for by the age of the patient, for in small children an acute intussusception seems to take about six or seven days to kill, if it persists and is untreated   In several cases it is recorded that the patient was moribund on admission after a typical history of six days' duration The shortest history in the series of chronic cases, on the other hand, was three weeks , the gut was not gangrenous and the symptoms had not been severe

The series as it stands consists therefore of 400 cases, and does not fall far short of the total number dealt with by the hospital during the eighteen years included in the period 1903–20   This series, as far as we know, is the largest consecutive series yet investigated   Leichtenstern[1] collected 593 cases, but these were drawn largely from the literature of the subject   Since it is chiefly unusual cases that find their way into the literature it is clear that deductions drawn from a collection such as Leichtenstern s are liable to many fallacies   An excellent example is afforded by his statement that 12 per cent of all intussusceptions undergo spontaneous elimination , while our series does not

provide a single example of spontaneous elimination   While it is only fair to point out that Leichtenstern's paper was published in 1873, when laparotomy was practically unknown, and thus opportunities were given for spontaneous elimination to occur which the present practice of early surgical intervention does not provide, still the figures he gives of the number of spontaneous eliminations could only have been obtained from records composed mainly of abnormal cases

To a certain extent the same criticism applies to Fitzwilliams'[2] series of 1000 cases, including as it does cases published in the *Lancet* and the *British Medical Journal* for the seventeen years up to the date of writing the paper, viz , 1908, as well as cases drawn from other sources   It will be seen, however, that the statistical results obtained from Fitzwilliams' series are in substantial agreement with our own

ETIOLOGY

Sex —There is a marked preponderance of males over females   The ratio is roughly 2 1 to 1 0, the numbers of each sex affected in the series being 272 males and 128 females, i e , 64 per cent of all cases are males   This ratio is practically the same as that obtained by Fitzwilliams, who in 788 cases found 536, or 68 per cent, males   Adams'[3] series of 100 cases gives a similar number of males affected, viz , 66 per cent   Leichtenstern's series of 593, a ratio of 1 8 to 1 0

Age —*Fig* 42 shows the age incidence in years   It is seen that the vast majority of cases occur during the first two years of life   Of the four hundred patients, 314 were under the age of two years, a percentage of 78 5, while 279 were under the age of one year, a percentage of 69 75   The chart illustrates the age incidence up to the fourteenth year only   There were 18 cases over the age of fourteen   These fell between the fifteenth and fifty-eighth year of life The age of the youngest patient in the whole series was one day, of the oldest fifty-eight years   While in the case of the infant surgical intervention was unavailing, it is gratifying to record that at the other extreme of life an uninterrupted recovery of the patient rewarded the surgeon's efforts

In a series of 648 cases under the age of twelve years, Fitzwilliams found 71 9 per cent occurred in children not more than twelve months of age
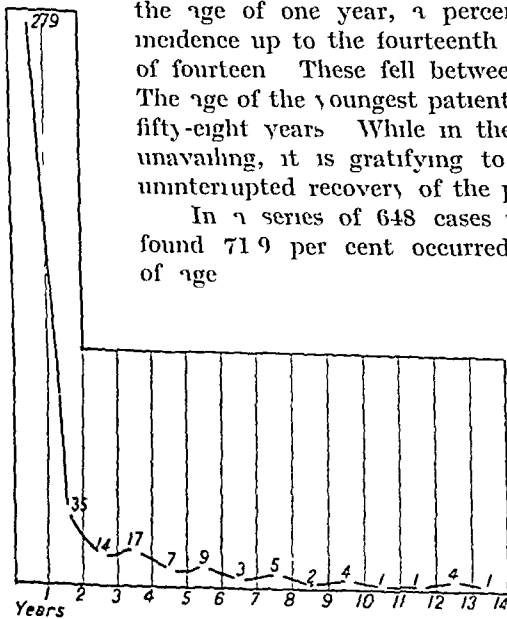
Fig 42 —Curve illustrating the incidence of acute intussusception in year   35 cases are included in the curve which cover it the age of 14 year   for convenience of insertion   18 other cases occurred between the age of 15 and 58 making the total 400
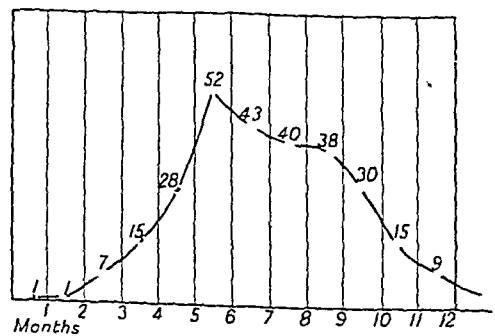
Fig 43 —Graph of age incidence of acute intussusception in months during first year

That 78 5 per cent of all acute intussusceptions occur in children under two years suggests that some peculiar mechanism is in operation at this period   An analysis of the age incidence during the first year of life throws further light upon the question   *Fig* 43 shows the number of cases occurring in infants during each month of the first year   It is seen that the curve rises steeply till five months of age, when the maximum is obtained From this point there is a gradual fall till the age of nine months is reached, when the fall

is steeper   Of the 279 cases within the first year of life, no less than 203 (72 7 per cent) occur between five and nine months   Of all cases of acute intussusception of every kind, 203 out of 400 (rather more than 50 per cent) occur between the ages of five and nine months

Fitzwilliams' curve, constructed from 458 cases occurring under twelve months of age, is similar to the above   His maximum occurs, however, at six months, and the curve rises from three months and falls from six to nine months much more sharply than our own

That 50 per cent of all intussusceptions occur between the ages of five and nine months provokes the inquiry whether there is any constant change in growth or environ ment likely to be correlated with this peculiar incidence   Two such changes at least invite attention   From five to nine months is the period when teething with its associated gastro-intestinal disturbances commences, and at five months also the supply of the maternal milk is in many cases becoming inadequate to the needs of the growing child, and, as Fitzwilliams points out, breast feeding frequently begins to be supplemented by other foods   The possible bearing of this factor on the production of intussusception will be referred to later

Season —*Fig* 44, describing the seasonal incidence, shows two maxima in the months of April and January   It further reveals the fact that 60 per cent of the cases occurred in the first six months of the year   The spring months of March, April, and May furnished 132 cases, while the autumn and early winter months of September, October,
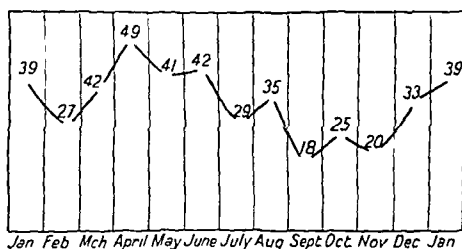
Fig 44 —Curve illustrating seasonal incidence of acute intussusception
No of cases in March to May   132
                   September to November   63

and November furnished only 63   The disease is thus twice as prevalent in the spring as in the autumn, and has a second increased incidence about *Christmas* time   This agrees with Fitzwilliams' curve of 453 cases, with the curious difference that both his maxima occur a month earlier than our own, viz , March and December instead of April and January

Relation of Intussusception to Seasonal Diarrhœa —There is no relation between this disease and intussusception   The most cogent argument is that during the year 1911 when a severe epidemic occurred, no cases of intussusception were admitted to the hospital during the month of September when the epidemic was at its height   Again, investiga tion of the histories shows that in the 156 examples of ileocæcal intussusceptions only 11, and in the 126 ileocolic only 3, had a history of diarrhœa   A larger number of colic intus susceptions had a previous history of diarrhœa, 6 out of the 19 possessing histories lasting from three days to one week

Relative Frequency of the Various Types —The following *Table* gives the relative frequency of the various types   We think the figures are substantially accurate in spite of the difficulty of deciding at operation the precise variety dealt with   The numbers are fairly large and, upon the whole, as many cases of the ileocolic type will be wrongly described as ileocæcal as vice versa   Intussusceptions of other kinds are not likely to be confused with each other   It will be noted that in comparing our series with other observers' statistics, ileocæcal, caput-cœci, and ileocæcal-caput cœci types are all lumped together as ileocæcal   The reasons for adopting this course are given in the discussion of the caput cœci variety

Table I—Showing the Relative Frequency of the Different Types of Intussusception

Variety	Males	Females	Both Sexes	Own Series Total	Own Series Per cent	Leichtenstern Total	Leichtenstern Per cent	Fitzwilliams Total	Fitzwilliams Per cent
Ileocaecal	73	40	113 } ileo caecal	156	39 0	212	44		60 5
Caput coeci	29	9	38						
Ileocaecal and caput coeci	3	2	5						
Ileocolic	90	36	126	126	31 5	39	8		25 6
Enteric	17	10	27	27	6 75	142	30		7 3
Colic	12	7	19	19	4 7	86	18		6 6
Compound	2	2	4	4	1				
Retrograde	1	1	2	2	0 5				
Meckel	4	1	5	5	1 2				
Unclassified	39	20	59	59	14 7				
Appendicular	1	0	1	1	0 2				
Jejunogastric	1	0	1	1	0 2				
Totals				400	99 75	479	100	506	100

Including intussusceptions involving Meckel's diverticulum as enteric placing the retrograde intussusceptions in their appropriate anatomical class, and assuming the same proportion of all classes of intussusceptions included in the group of 59 cases catalogued as unclassified, the percentages of different types in our series would still differ considerably from those of Leichtenstern and Fitzwilliams. This is found to be the case, for, excluding compound, appendicular, jejunogastric, and the unclassified group, and grouping the intussusceptions involving Meckel's diverticulum and the two retrograde cases among the enterics to which they belong, a net total of 335 cases is obtained, and the percentages then work out as follows —

Table II

Variety	Total	Per cent	Leichtenstern per cent	Fitzwilliams per cent
Ileocaecal	156	46 5	44	60 8
Ileocolic	126	37 6	8	25 6*
Enteric	34	10 1	30	7 3
Colic	19	5 6	18	7 3
Multiple and Double	—	—	—	6 1
Totals	335	99 8	100	99 8

* Includes all enterics

If the 19 chronic cases are added to the series the percentage of colic intussusceptions is slightly raised

The numbers and percentages in the three series are then as shown in *Table III*

Table III

Variety	Own Total	Own Per cent	Leichtenstern Total	Leichtenstern Per cent	Fitzwilliams Total	Fitzwilliams Per cent
Ileocaecal	163	46 9	212	44		60 5
Ileocolic	128	36 8	39	8		
Enteric	36	8 3	142	30		25 6
Colic	27	7 7	86	18		7 3
Totals	354		479		506	

It is a little remarkable that our series should differ as much as it does from Fitz-williams' in the relative frequency of the ileocæcal type   The terminology, however, is in such confusion that it is quite possible cases described as ileocolic in our series would be recognized as ileocæcal by other surgeons, and the discrepancy between our figures and Fitzwilliams' thus be accounted for   As we shall have occasion to point out, even with a clearly-defined terminology at our disposal, it is sometimes not easy to determine whether an intussusception arising in the neighbourhood of the ileocæcal valve is ileo cæcal or not   In any case, accurate statistics of the relative frequency of the ileocæcal and ileocolic varieties will not be obtainable until a universally recognized classification is adopted

The difference between our series and Leichtenstern's is easily accounted for   As Fitzwilliams justly observes, since Leichtenstern's paper of 1873 intussusception has probably been more frequently diagnosed in young infants, and thus the proportion of ileocæcal and ileocolic intussusceptions should be greater   This is strikingly borne out by examination of the 131 cases of intussusception collected by Waren Tay in 1873 and appended to Sir Jonathan Hutchinson s paper[1]   Of the total number of 131 cases only 62, and of the cases described as recovering only 6, were in children under one year of age

TERMINOLOGY

In the foregoing section the terminology we have adopted has been given with the reservation already expressed that we consider the caput-cæci and ileocæcal-caput cæci varieties to be really ileocæcal   However, a short discussion of the various terms is necessary, because different authorities use the same words in somewhat different senses, and, as many different surgeons have operated on the 400 patients in our series, it is needful to make certain that the same terms are always used in the same way   We will therefore consider each of these in turn

Ileocæcal.—The term ileocæcal was used by the older surgeons up to 1873 to describe any type of intussusception occurring in the region of the ileocæcal valve, and thus included many cases which would now be described as ileocolic   Since Leichtenstern s paper of 1873 the term has been restricted to the forms in which the ileocæcal valve itself heads the intussusception   It is in this sense exclusively that the word has been used by the London Hospital surgeons, for although on consulting the records of the ileocæcal cases we find that the vast majority are described simply as ileocæcal, in many specific cases mention is made that the ileocæcal valve formed the apex of the intussusception   In others, the ileocæcal valve and appendix are described

Labels in figure: ANT TAENIA; POST TAENIA; ILEO CAECAL FOLD OF TREVES; MESENTERY OF APPENDIX; ORIFICE OF APPENDIX; EXT TAENIA; ANT TAENIA
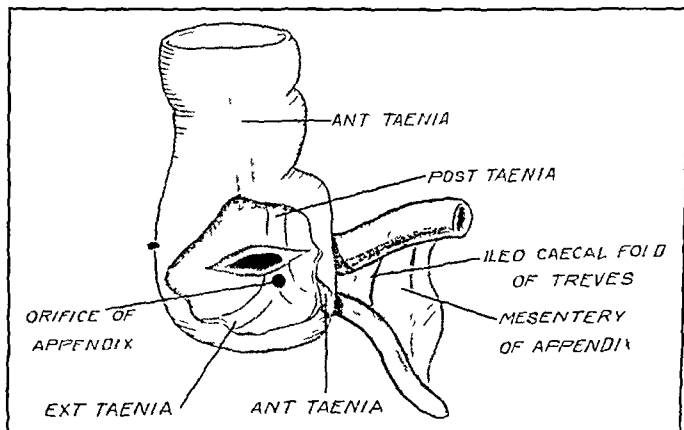
FIG 4)

as together forming the apex   Again, of other cases which reached the post-mortem room, in two ulceration of the ileoc cæl valve is recorded , in another a lump at the ileocæcal valve is described , in a third, the ileocæcal valve is described as chronically thickened   and in all the valve is mentioned as constituting the apex   Further con firmatory evidence that the term ileocæcal has been properly used is furnished by the frequent mention in cases which died that the cæcum and appendix were 'gangrenous'

'easily broken through', much engorged', or 'much congested' , for it is on the appendix and cæcum that the main pressure falls in this type This statement will be fully discussed in the section dealing with the caput cæci variety Lastly, in perusing the notes made on the ileocolic form, we find that intussusceptions originating as close to the ileocæcal valve as one inch are correctly described as ileocolic

Caput cæci —This variety was first described in detail by Sir Frederic Eve[5] in 1899 as the cæcal or caput-cæci variety, although mention is made by Lewis Smith, in 1862[6], of intussusceptions beginning in the caput cæci It has been assumed that the inversion commences by the apex of the cæcum becoming invaginated, the ileocæcal valve and appendix being drawn in later We agree with Barnard's view[7] that the inversion is only a ' secondary and unimportant result of ileocæcal intussusception ' The way this dimpling of the cæcum is produced is probably is follows Reference to *Fig* 45 of the cæcum and ascending colon

FIG 46 —A Longitudinal section of ileocæcal valve of child one year old B Longitudinal section of ileocæcal valve of child three months old

will show that immediately below the ileocæcal valve lies the orifice of the appendix surrounded by the fused tæniæ of the ascending colon At this point also the ileocæcal fold of Treves and the base of the mesentery of the appendix are attached to the ileocæcal junction In addition, the lymphoid tissue is particularly thickly aggregated at this point (*Fig* 46, B) Consequently, in the ileocæcal variety of intussusception the apex though mainly formed by the ileocæcal valve, really also includes the base of the appendix As these advance, the portion of the cæcum lying between the external and anterior tæniæ comes to form that layer of the apex of the intussusception which is in immediate apposition to the mass formed by the appendix, the root of the appendicular lymphoid tissue of this area

ILEO COECAL VALVE

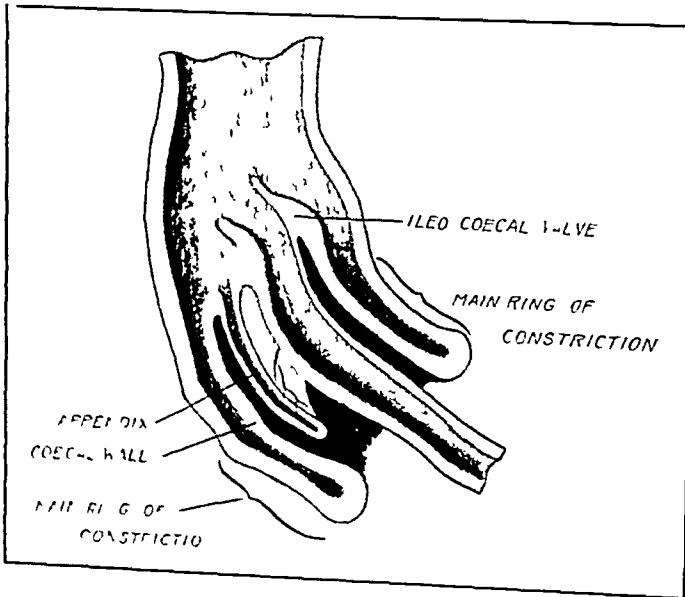MAIN RING OF CONSTRICTION

APPENDIX

COECAL WALL

MAIN RING OF CONSTRICTIO

FIG 47

mesentery the ileocæcal fold of Treves and the associated lymphoid tissue (*Fig* 47) As Barnard points out the great cause of the obstruction of an intussusception

is the active and vital contraction of its sheath and especially at its neck " The portion of the cæcum, therefore, which lies in immediate contact with the congested and swollen appendix will naturally share in the common œdema of the rest of the apex

Fic 48

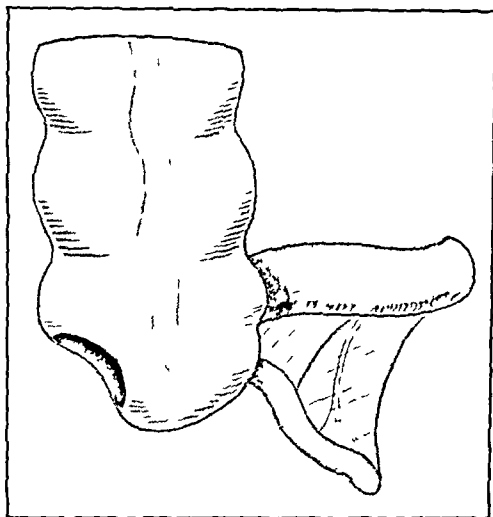and on reduction will present the characteristic dimpled appearance illustrated in *Fig* 48

According to the amount of pressure exerted by the sheath on the neck of the intussusception, so will the dimple be more or less marked It is to be anticipated that neither in very early nor in very late cases will the dimple be at its maximum In the former, sufficient pressure will not have been exerted to cause such œdema, while in the latter the pressure will have produced gangrene and atrophy of the wall It is a commonplace of surgical observation that a strangulated hernia of long duration presents an easily torn, thin, and flaccid wall It is only in cases of medium duration that much œdema of a strangulated loop is present The mortality of ileocæcal intussusceptions described as caput-cæci should therefore be less than that of those described as ileo cæcal only this is in fact, the case The percentage mortality of intussusception described in the series as ileocæcal is 35 9 per cent that of intussusception described as caput-cæci is 23 3 per cent

In most cases in which we ourselves have operated on an ileocæcal intussusception this dimpling is more or less marked In other words, every ileocæcal intussusception is also a caput-cæci in a more or less marked degree It may be urged, why does not a similar dimpling of the wall of the cæcum take place in ileocolic intussusceptions, in which the apex is formed by a segment of the small intestine close to the ileocæcal valve which passes through the ileocæcal valve, moves down the colon, and drags the valve and cæcum after it ? Where the apex of the ileocolic in tussusception is formed by a section of the ileum very close to the valve —say within an inch—such a dimp ling may occur, and undoubtedly does , but where the apex is formed some distance off, the explanation is that the wall of the cæcum no longer forms a portion of the apex of the intussusception, and in conse quence does not become so œdema tous It is more likely to be flattened by continuous pressure of the ensheathing layer at the neck of the intussusception (*Fig* 49)
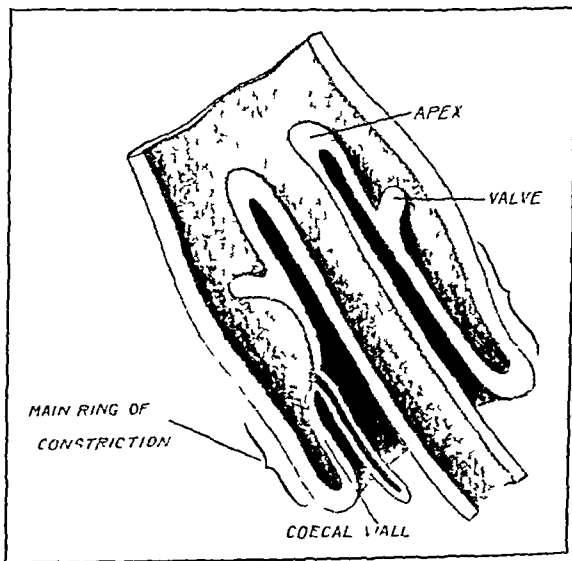

APEX
VALVE
MAIN RING OF CONSTRICTION
COECAL WALL

Fic 49

Both Fitzwilliams and Walton[8] agree that the caput-cæci variety is probably nearly

always a secondary result of an ileocæcal intussusception Fitzwilliams lays stress, however on a secondary slipping of the cæcal wall over the original apex formed by the ileocæcal valve, so that the dimpled portion of the cæcum represents a later-formed apex of the intussusception We do not find ourselves in agreement with them on this point The ileocæcal valve is, as *Fig* 50 shows, a very large and prominent structure It is not easy to see how the wall of the cæcum can slip down over the valve to produce a secondary apex, and such a slipping is entirely contrary to the otherwise universal method of growth of an intussusception, in which the original apex is the one fixed point Again if such an initial prolapse occurs, why should it not continue? Furthermore, we ourselves have

not found, in reducing ileocæcal intussusceptions, that the last part of the intussusception to be reduced is the dimpled part of the cæcum

Fitzwilliams, in common with other observers, points out that the orifice of the intussusceptum usually points towards the mesenteric side of the gut and away from the convexity of the intussusception, and adduces this as evidence of the slipping down of the returning layer of the intussusceptum opposite the attached mesenteric border It seems more likely that this position of the orifice is due primarily to the friction of the mesentery, which produces the characteristic curve of an intussusception, and, secondarily, to the greater ædema of that lip of the apex which is opposite the mesenteric border of the intussusception for, as Barnard points out the ædema is always greatest along the convexity of the intussusception

Ileocæcal and Caput-cæci—It will be noted that 5 cases are designated ' ileocæcal and caput-cæci In other words the surgeon was unable to decide to which type the intussusception belonged, and

accordingly give the double description The description of these 5 cases gives additional evidence in favour of the view put forward above In our opinion, use of the terms cæcocolic, caput-cæci and ileocæcal-caput-cæci should be discontinued and the term ileocæcal intussusception be applied to all intussusceptions taking their origin in the ileocæcal valve which indeed always includes the base of the appendix, whether the dimpling of the cæcum, which has given rise to the creation of the unnecessary types variously called cæcocolic caput-cæci, and ileocæcal-caput-cæci, be present or not

Ileocolic.—From a close examination of the records, the term ileocolic has been uniformly applied to that type of intussusception in which an enteric intussusception close to the ileocæcal valve proceeds through the valve and drags the lips of the valve the cæcum and the appendix after, is part of the returning layer of the intussusception Figs 51 52, 53 54 illustrate the stages in the process

The term ileocolic however has not been universally applied to this type of intussusception At any rate we can find no record in any earlier papers of the use of this
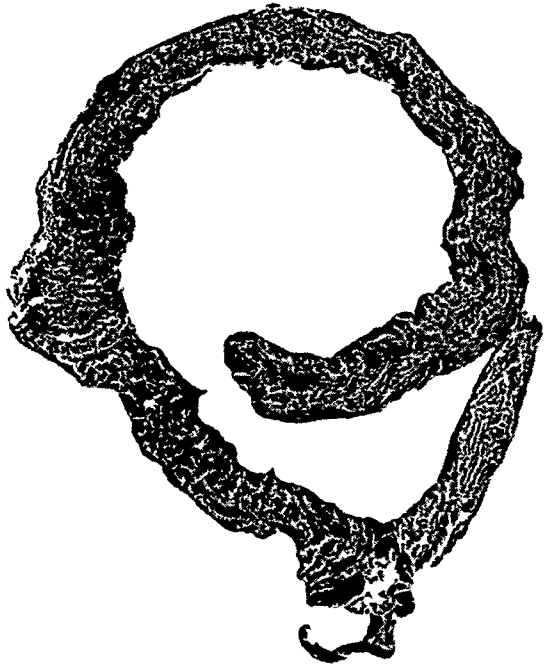
term, though from time to time accounts are given of intussusceptions consisting of a protrusion of ileum through the ileocæcal valve into the colon   In 1860, for example Duchaussoy[9] in his monograph collected four cases   All these earlier writers, however were content with recording the condition without giving it a name, an admirable example which has alas, not been widely followed   The term was first employed by Leichtenstern in his monograph of 1873, in which he classifies intussusception into four groups, ileocæcal
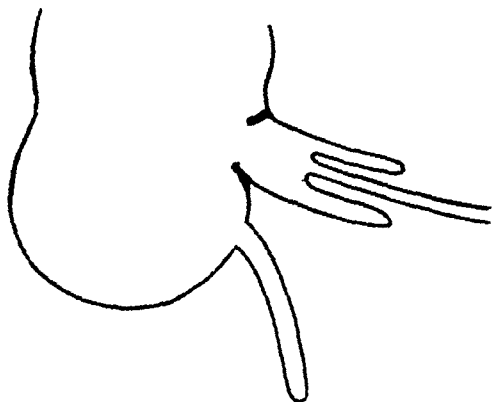
FIG 51
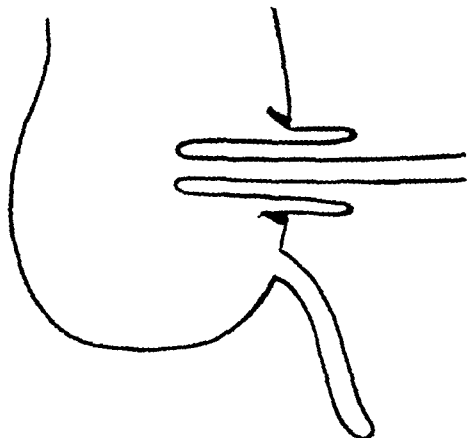
FIG 52

enteric, colic, and ileocolic, the last taking origin as an 'Einstulpung of the ileum through the ileocæcal valve   Four years later, in his article in Ziemmsen's Cyclopædia [10] he claims responsibility for the term ileocolic and again defines it in the following words ' Another form is that which I have named ileocolica   This kind of invagination represents a pro lapse of the ileum through the ileocæcal opening   English literature contains several very close descriptions of ileocolon intussusceptions '   He then proceeds to give

FIG 53
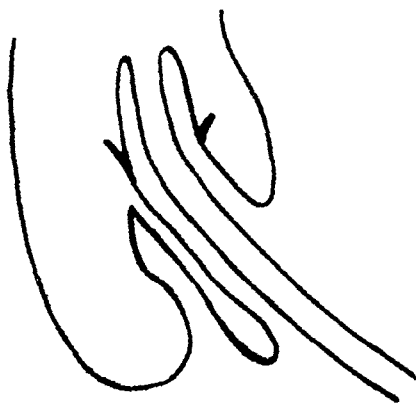
FIG 54

an account of the variety we have described above (*Figs* 51–54) as forming the ileocolic of our records, and gives to it the name iliaca ileocolica   He points out that at one stage of its progress an iliaca-ileocolica is indistinguishable from an ileocolic   This is the stage represented in *Fig* 53   Sherren[11] has described an enteric intussusception in the act of passing through the ileocæcal valve, and expresses the view—with which we are entirely in accord—that the vast majority of ileocolic intussusceptions take origin in this way as

enteric intussusceptions   Walton has elaborated the same argument, viz   that an ileo-colic intussusception is only a stage in the normal growth of an enteric as it passes down into the colon

Examination of our records throws considerable light on this question, when the facts are considered in relation to the method of growth of ileocolic intussusception as defined by Leichtenstern   This method of growth is well described by Barnard as follows   " In simple ileocolic intussusceptions the ileocolic valve stands fast while more and more ileum is prolapsed through its orifice into the cæcum   Growth takes place entirely at the expense of the entering layer '   It follows from this method of growth that Leichtenstern s ileocolic intussusception has no constant apex, it is constantly changing, and no swollen œdematous segment of gut is produced which can afterwards be identified as the apex   Furthermore, from the method of growth, reduction should be easy, nor can there ever be such pressure on the appendix or cæcum as to warrant resection   Now, in 16 per cent of our series of ileocolic intussusceptions the exact position of the apex is described, in another 6 2 per cent appendicectomy was performed, and in another 27 8 per cent either resection was performed or reduction was described as difficult   Thus, in 50 per cent of all the cases described in our series as ileocolic there is evidence that the condition originated as an enteric intussusception   It may certainly be argued that an intussusception may start as a prolapse of the ileum through the valve , that this may then cease, and the prolapsed segment form the apex of an intussusception growing in the normal way at the expense of its sheath   In view, however, of the thickness of the collar of lymphoid tissue which forms the terminal $\frac{3}{4}$ in of the ileum up to the age of one year— and it must be remembered that 71 4 per cent of ileocolic intussusceptions occur during the first twelve months of life—such a prolapse does not seem likely   In any case, it seems a pity to erect a classification on a hypothetical method of growth for the existence of which evidence is very difficult to adduce

Frequent mention is made in the literature of small degrees of prolapse in the mucous membrane of the ileum through the ileocæcal valve   The question arises in our minds whether the degree to which the ileocæcal valve projects into the colon in young children has been fully realized   If the origin of an ileocæcal intussusception is, as we believe, to be explained by an inflammatory œdema of the valve, the swollen valve might easily be interpreted as an evagination of mucous membrane, and thus prolapse of the ileal mucous membrane considered to be more common than is prob-ably the case

In spite of the fact that the term ileocolic by virtue of priority should be used to designate prolapse of the ileum through the valve, we are inclined to suggest that the term be used to denote any form of intussusception in which the ileum is found inside the colon whether half-way through the valve, completely through, or with the ileocæcal valve dragged after it as a constituent of the returning layer   We exclude, of course, any form of double intussusception, which should be classified as compound

A brief analysis of the 18 ileocolic cases in which the position of the apex is described may be of interest   In 2, the apex was eighteen inches above the valve , in 1, one foot above the valve   in 1, eight inches, and in the remaining 14, six inches or less   The majority, therefore, start quite close to the neighbourhood of the valve   It is clear that every ileocolic intussusception is primarily enteric   Among the enteric forms we have, however, included only those which have stopped short of the ileocæcal valve

Enteric.— Of this variety 27 cases are recorded   The term requires no elucidation or special comment   However, it is noteworthy that some anatomical source of origin of the intussusception is more frequently mentioned in the notes on this variety than in any other   for in 6 of the 27 cases some such condition was recorded   In 2 a congenital constriction occurred   in 2 there was tuberculous ulceration of the gut, in 1 a polyp was present   and in another a myomatous tumour

Compound.—This variety numbers 4 cases   The first occurred in a child age ten months and was a double colic intussusception   The apex was situated 2 in distal to the cæcum   carried the cæcum with it, and then the whole was again intussuscepted   The

intussusception was reduced, but death ensued   The second was in a child of seven months   The last foot of the ileum was invaginated into itself and pushing the ileocæcal valve in front of it was invaginated *en bloc* into the colon   The third was a similar one in a child, age nine months   The apex was 9 in from the ileocæcal valve, and the enteric intussusception thus formed pushed the ileocæcal valve in front of it and passed into the colon   The fourth and last began as an ileocolic intussusception and, when 9 in of ileum had passed through the ileocæcal valve, the colon was invaginated into itself

To certain of the above, specific names have been applied   In pursuit of simplicity of nomenclature we prefer to describe them all simply as compound   We are disposed to think that double intussusceptions are rather commoner than the series shows   In one case included among the ileocæcal variety the notes say that the intussusception was double for the last 1½ in

It is the practice in reducing intussusceptions to squeeze as much of the intussusceptum back as can be done inside the abdomen, and thus many double forms are likely to be missed   Double, triple, and quadruple forms of intussusceptions are, however, of academic interest only   The only difficult portion of an intussusception to reduce is the portion first formed , superadded invaginations are readily reduced with a little manipulation

The above brief discussion of the terminology which has been employed, and consideration of the evidence provided by our own cases, show that reasons have been given in common with other writers for the abolition of the terms caput-cæci, cæcocolic, and ileocæcal-caput-cæci, as being only variants of the term ileocæcal   The 'simple' ileocolic of Leichtenstern, it has been suggested, should disappear on account of its rarity and doubtful existence, and be described as prolapse of the ileum , and the term iliaca ileocolica likewise, the term of ileocolic taking its place

We are thus in substantial agreement with the views expressed by Fitzwilliams in his admirable paper published in the *Lancet* in 1908   He states   " Up to quite recently the usual forms described were the enteric, the colic, the ileocæcal, and ileocolic   This classification is the simplest and the most complete, and, with the exception of the name ileocolic, gives a correct idea as to the starting-point of each variety   but this simple classification has to its detriment been elaborated   until in a recent paper in the *Transactions of the Clinical Society* there was some hesitation expressed as to whether the correct name for a particular form of intussusception was entericileocolic, ileocæcal, or entericileocolicileocæcalcolic '   To this simple classification of intussusceptions into four varieties we have added compound, appendicular, Meckel, jejunogastric, and retrograde We think that the term 'compound' has its uses as including many rare intussusceptions for which a separate name must otherwise be invented, while the very rare intussusception taking origin in the inversion of the appendix must remain classified under a separate heading   Meckel, and jejunogastric intussusceptions, rare enough, are of course only special varieties of enteric intussusceptions, and obviously all retrograde intussusceptions are classifiable under one of the above four headings   There is something to be said for keeping these last five varieties, viz , compound, appendicular, Meckel, jejunogastric, and retrograde, as separate classes, for the terms are self-explanatory, and the examples are so rare that it does not materially affect any statistics of the four chief types whether they are included among the particular number of these four to which they belong or not

The aim of all nomenclature should be to make description easier, and this the above method of classification attains, for we have only one, the 'ileocolic , which is not self-explanatory and that is employed to designate one of the most common types of intussusception which could not be conveniently described otherwise than by some such artificial name   We are much opposed to designating every possible variety of intussusception by some separate name   If this be done the list becomes almost endless and serves no useful purpose   for example, within the limits of one single and otherwise admirable paper (we offer our humble apologies for the criticism) no less than eighteen different terms, many very complicated, are proposed to define different types of intussusception

CAUSATION OF INTUSSUSCEPTION

As a preliminary to discussing the causation or mechanism of the production of intussusception the attention of the reader is invited to the curves in *Figs* 55–58 illustrating the age-incidence of the various types of intussusception The curves show the age incidence in the first few years of life only The sporadic cases which are scattered throughout the remaining years of existence are appended in the form of a list, as their inclusion would make the curve too lengthy to be conveniently inserted It will be noted that to each curve a list is attached of the chronic cases of each type which have come under our notice but otherwise have not been included in our list of 400 acute
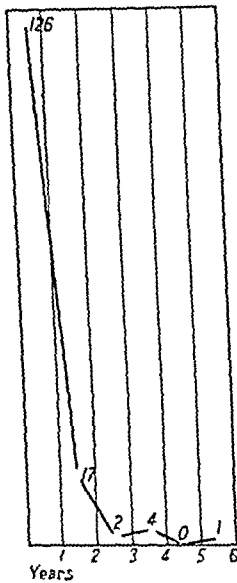
Fig 55 —Graph showing the incidence of acute ileocaecal intussusception Six other cases occurred at age 9 11 27 41 44 of Seven chronic ileocaecal intussusceptions occurred at age 2, 5 10 40 (carcinoma of valve), 44

Fig 56 —Graph showing age incidence of acute ileocolic intussusceptions Five other cases occurred at age 20 (two) 30 32, 40 Two chronic ileocolic intussusceptions occurred at age 59 and 68 (button carcinoma is apex)
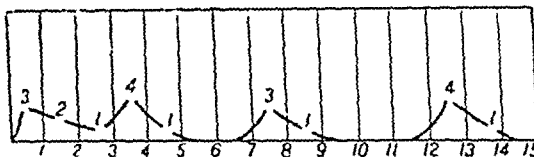
Fig 57 —Graph showing the incidence of acute enteric intussusception Seven other cases occurred at age 19 (tuberculous ulceration of gut) 15 (two) 41 and 8 Two chronic enteric intussusceptions occurred at age 2 and 18
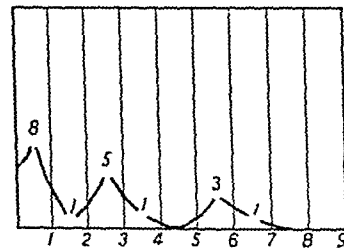
Fig 58 —Graph showing age incidence of acute colic intussusceptions Eight chronic intussusceptions occurred at age 29 (two myoma and carcinoma is apices) 4 (adenoma), 44 (carc) 48 (carc), 59 (carc), 51 (carc) 61 (primary)

intussusceptions A chronic intussusception differs from an acute one in the symptoms it produces but its causation is probably the same, and as most of these chronic cases are met with during the early and later years of adult life their omission would affect the age incidence of the various types to a slight degree These chronic intussusceptions are 19 in number

It is clear from a glance at these charts that any theory of the causation of intussusception must satisfactorily explain two things (1) Why all types of intussusception are more common in the first few years of life and (2) Why ileocaecal and ileocolic intussusceptions are much more common than either enteric or colic

Let us examine the theories that have been advanced to account for the origin of intussusception, in the light of their ability to satisfy the above two conditions   Broadly speaking, three separate theories have been advanced to explain the method of formation of intussusception   (1) *Perverted peristalsis*, (2) *Paralytic conditions of the gut allowing the prolapse of one portion into another*, (3) *The presence of some congenital abnormality such as a constriction, or new growth such as a carcinoma, acting as the exciting cause*   We exclude Barnard s hypothesis that flexures in the gut and diverticula are causes of intussusception   As Barnard himself points out, 'dimpling in' of a flexure or inversion of a diverticulum must first take place before an intussusception can arise   It is precisely the explanation of this 'dimpling in or inversion that we are seeking

1 **Perverted Peristalsis**—Discussing each of these suggested causes of intussusception in turn, there can be no doubt that perverted peristalsis is one of the ways in which an intussusception may arise   Many surgeons, including the authors, have actually witnessed the manufacture and disappearance of intussusceptions during operation Again, although in our series only two cases of retrograde intussusception occur, they do occur, others are recorded in the literature, and there is no explanation apart from perversion of the normal movements of the gut to account for them   Further, the frequent occurrence of multiple agonal intussusceptions lends this possibility support   Undoubtedly a certain number of intussusceptions originate in this way   We cannot, however, assume that abnormalities in the movements of the gut will account for most intussusceptions, when the hypothesis is tested against the two conditions just mentioned   The first condition required, that of accounting for the increased frequency of intussusceptions during early life, is fairly well met, granting that, during the earlier years of life, and particularly during the period of weaning, digestive disturbances with—presumably—an associated abnormality in peristaltic movement are most common   The hypothesis, however completely fails to explain the second question, why the majority of intussusceptions are ileocæcal or ileocolic, for it cannot be assumed that abnormal peristaltic movements are chiefly confined to the ileocæcal valve or the last few inches of the ileum, the two regions where the ileocæcal and ileocolic varieties respectively take origin

For the hypothesis to hold good that perverted peristalsis is the main causal agent in the production of intussusception, the number of ileocæcal, ileocolic, enteric, and colic intussusceptions should be approximately the same   Reference to the curves shows that this is not so   The percentages of each variety work out as follows   ileocæcal 46 5, ileocolic 37 6, enteric (including those involving Meckel s diverticulum) 10 4, and colic 5 6

Certainly it may be urged with reason that the ileocæcal valve itself is more likely to act as the apex in any unusual peristaltic movement, owing to the manner in which it projects into the cæcum, and thus the high proportion of ileocæcal intussusceptions can be explained   but the same anatomical peculiarity does not exist in the last few inches of the ileum where the ileocolic variety takes origin

Perverted peristalsis alone cannot be held to account for the majority of intussusceptions

2 **Paralytic Conditions of the Gut allowing of Prolapse of one portion into another**—The same objection applies to this suggestion as to the perverted peristalsis hypothesis   Why should paralytic conditions of the gut occur most commonly at or just above the ileocæcal valve ?   It is conceivable that the ileocæcal valve, projecting as it does into the cæcum, would more readily prolapse on very slight provocation than any other section of the gut, but the same plea cannot be urged to account for the almost equally numerous ileocolic variety   Furthermore, it is not easy to account for the greater frequency of intussusceptions of every type during the first years of life—the first condition, it will be remembered, that any hypothesis must satisfy—for there is no reason to suppose that paralytic conditions of the gut are any commoner during early life than at any other period of existence

3 **The Presence of some Congenital Abnormality such as a Constriction, or of some Growth such as Carcinoma, acting as the Exciting Cause**—Put in the above form, this hypothesis can be ruled out straight away   It will not account for the greater

prevalence of intussusception during the earlier years of life, for it cannot be shown that either new growths or unusual anatomical conditions are more common early in life   In the case of colic intussusceptions, for example precisely the opposite is true   In none of our 19 cases during the first seven years of life is a growth recorded as forming the apex of the intussusception, while in the 8 cases which occurred during the age limits of 29 to 61 a growth is described as forming the apex in no less than 7   Still less will this hypothesis account for the preponderance of ileocæcal and ileocolic intussusceptions, for in only 1 ileocæcal intussusception out of 156 is a growth described as being on the valve, and in only 1 ileocolic out of 128, and that a chronic intussusception in a patient, age 68, is a growth—a 'button' carcinoma—mentioned as the apex   Objections could be readily multiplied were such multiplication necessary

Although new growths and abnormal conditions in the gut-wall can and do excite the formation of intussusceptions, they do not account for the majority

Method of Formation of Ileocæcal, Ileocolic, and Enteric Intussusceptions —An examination of the structure of the terminal portion of the ileum and ileocæcal valve at different ages provides, in the case of the ileocæcal, ileocolic and enteric varieties, the probable solution of the dual problem of, firstly, why intussusceptions are more common during the first two years of life, and secondly, why the majority of intussusceptions should be ileocæcal or ileocolic   Conclusions drawn from this examination obviously cannot explain either the mechanism of formation of a colic intussusception and the age incidence of this form, or the mechanism of formation of an intussusception of Meckel's diverticulum   The probable method of origin of these last two is given later

FIG 59

Fig 59, which represents the last few inches of the ileum and the interior of the cæcum with the ileocæcal valve in a child, age three months, shows that the ileocæcal valve is annular in shape, is covered with masses of lymphoid tissue (*Figs* 46 B, 60, and 61), and projects for some ¾ in into the cæcum   The terminal inch of the mucosa of the ileum is studded with masses of lymphoid tissue which form a complete ring round the lumen of the gut   This aggregation of lymphoid tissue becomes gradually less and less marked as the ileum is examined farther away from the valve until, at a point some 6 in above the valve, except for isolated Peyer s patches, there is no special aggregation to be found
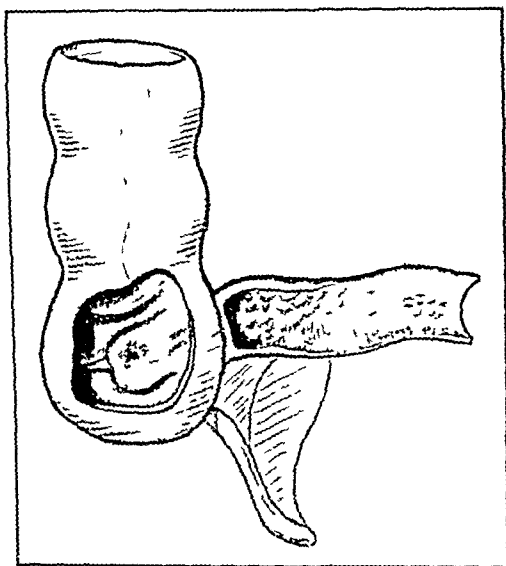
In *Figs* 46 A and 62, which represent the same region of the gut in a child one year old, it is seen that the ileocæcal valve is still prominent, but the patch of lymphoid tissue at the termination of the ileum though well marked, is less developed

A consideration of these figures shows that during the first year of life the quantity of lymphoid tissue in the ileocæcal valve, and the degree of projection of the valve into the cæcum, is at its maximum   Both are much less marked during the second year, and the prominence of each gradually decreases as adult life is attained   In other words, the lymphoid tissue and prominence of the ileocæcal valve vary in direct ratio with the incidence of the ileocæcal type of intussusception   A similar relation is seen to exist between the quantity of lymphoid tissue in the last few inches of the ileum and the age incidence of ileocolic intussusceptions   Again, the amount of lymphoid tissue diminishes markedly as the number of ileocolic intussusceptions falls   Furthermore, it will be noted

that the lumen of the last portion of the ileum is relatively small during the first year of life Now, it has long ago been suggested that an inflamed Peyer's patch might act as the exciting cause of an intussusception   In view of this marked development of lymphoid tissue at and above the ileocæcal valve, and the rapid subsidence of the same during the second year of life, it is impossible not to connect the presence of this lymphoid tissue with the peculiar age and type incidence of intussusception   We think that, in the case of ileocæcal, ileocolic and enteric types, the majority of intussusceptions are caused by inflammatory swellings of lymphoid tissue   The age incidence is easily explained on this hypothesis for both lymphoid tissue and intussusceptions are at their maximum early in life, and particularly in the first year of life   The curious anatomical incidence of intussusceptions as shown by the great preponderance of ileocæcal and ileocolic intussusceptions is also explained, for, as the diagrams show, the quantity of lymphoid tissue round the ileocæcal valve is much greater than in any other part of the alimentary canal   The great prominence of the valve, and the narrow lumen of both ileum and — especially — colon during the first year of life[*] is also probably an accessory factor in the production of these two forms, for any swelling of either the valve or the lymphoid tissue would readily come into contact with the segment of gut immediately below the swelling, and be treated as a foreign body It is clear that should both the whole collar of lymphoid tissue and valve swell at the same time—no unlikely contingency—[†] an intussusception will be produced which, on reduction cannot easily be classified   Sometimes it will be interpreted
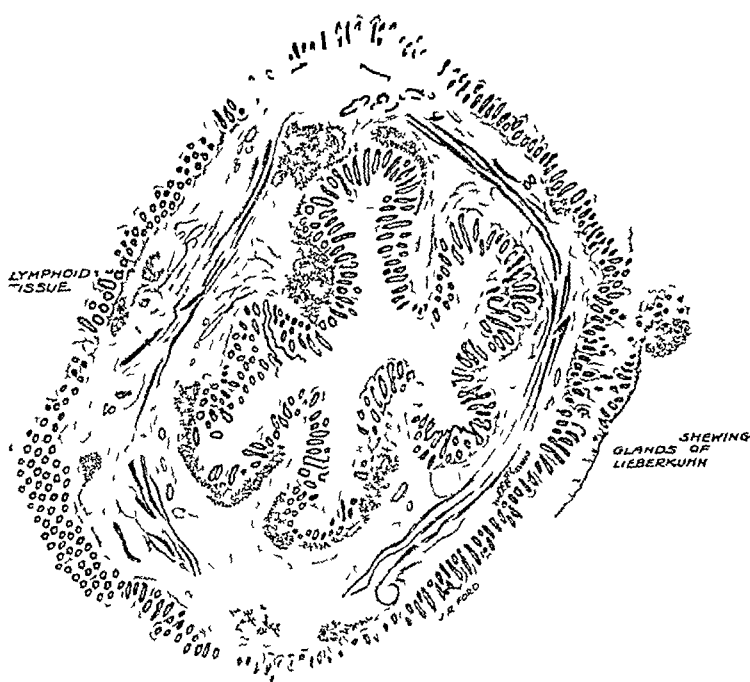
FIG 69 —Transverse section of ileocæcal valve of child age three month

as ileocæcal, sometimes as ileocolic   Really it is ileocæcal for of course the valve heads the intussusception   The disparity between our and Fitzwilliams statistics as to the relative frequency of ileocæcal intussusception may be due to this

The more the above hypothesis is examined the more is it seen to fit in with the various phenomena which any hypothesis of the causation of intussusception must explain It agrees, as already pointed out, with the two primary conditions calling for explanation, viz , the greater frequency of intussusception during the first few years of life especially the first, and the predominance of ileocæcal and ileocolic varieties over all others   Also it squares very well with the optimum age incidence of intussusception, which is during the first twelve months of life, viz   from five to nine months of age, when 50 per cent of all intussusceptions occur   This is the age when teething commences, when the maternal

* D'Arcy Power[1] has shown that at birth the diameter of the colon exceeds that of the ileum by only a few millimetres

† Ashhurst[13] has recorded a case in which swelling of this collar produced intestinal obstruction in the absence of any intussusception

milk is apt to be supplemented or replaced by other foods and gastro-intestinal disturbances, likely to be associated with swelling of lymphoid tissue in consequence, are rife. Again, the seasonal incidence, which shows maxima in the spring and the period just after Christmas, is adequately accounted for. At both these periods gastro-intestinal disturbances are common. Christmas, even for infants, is frequently a season of injudicious feeding and the spring, with Easter time the like. Again the hypothesis agrees well with the observation that it is nearly always fine fat babies that are subject to intussusception. It is in precisely these children that lymphoid tissue is best developed. At first sight it is curious that as our statistics show, there is no relation between the seasonal diarrhoea and vomiting of infants and acute intussusception. A closer analysis of the facts, however, reveals that no anomaly exists, for, while it seems reasonable to anticipate that in summer diarrhoea Peyer's patches and lymphoid tissue in general would be considerably swollen, exactly the reverse proves to be the case. Apparently

FIG. 61.—Longitudinal section of ileocæcal valve of child, age three months.

the inflammation is of such a nature as to produce shrinkage of the lymphoid tissue from the first, presumably by the great abstraction of fluid from the tissues which occurs in this complaint.

The foregoing hypothesis does not explain why males are more affected than females in the proportion of 2.1 to 1. One is driven to take refuge in the observation that male children are more susceptible than female children to all forms of infantile ailments.

One alternative offers itself. The incidence of intussusception has been shown to agree with the relative quantity of lymphoid tissue present in the gut. Male babies are, age for age, larger and heavier than female, and the lymphoid tissue of the gut varies directly with the size of the child. Possibly this is the true explanation of the greater susceptibility of the male.

Causation of Enteric Intussusception.—The origin of the majority is probably to be sought in the swelling of a Peyer's patch. It is interesting to notice however, how

relatively unimportant isolated Peyer s patches are in exciting an intussusception as compared with the closely-packed lymphoid tissue of the terminal few inches of the ileum, for the total number of acute enteric intussusceptions is only 27, as compared with 126 ileo colics, and of these 27 cases some precedent anatomical abnormality apart from lymphoid tissue, or some new growth, is present in no less than 6, whereas in only 2 of the 126 cases of ileocolic intussusceptions is the presence of a growth recorded   Reference to the curves with their appended lists gives the anatomical conditions found in each variety

Genesis of Intussusception arising in Meckel s Diverticulum—A slight modification of Barnard's explanation of the method of production of an intussusception in this region is probably the true one   He considers it arises by the   prolapse of the mucosa lining the diverticulum to a greater or lesser degree into the lumen of the ileum ' and cites Hohlbeck s case[14] in which the mucosa was completely everted without inversion of the muscular wall   When one reflects that Meckel's diverticulum is a blind tube, forcible

LOWER LIP
OF VALVE

COLLAR OF LYMPHOID
TISSUE IN TERMINAL
3/4 OF ILEUM

CÆCUM

APPENDIX IN SECTION

FIG 62 —Longitudinal section of ileocæcal valve of child, age one year

eversion of the mucosa into the ileum by contraction of the muscular wall of the diverticulum seems a likely thing to happen   It is, however, a method of formation of an intussusception which can occur in this particular region of the gut alone   Barnard seems to regard the eversion of the mucosa rather as a passive prolapse than the result of a forcible expulsion   Our observations on the firmness with which the mucosa is united to the muscular coat lead us to regard the eversion as more likely to be the result of forcible and prolonged peristalsis

Causation of Colic Intussusceptions—Examination of the curve of age-incidence shows that 19 cases occurred before the seventh year, all of which were idiopathic in their origin, that is to say, no growth or other exciting cause could be found to explain their production   After the age of seven, 8 chronic cases were recorded, only 1 of which, however, was primary   All of the remaining 7 could be accounted for by the presence of some new growth which formed the apex   The limitation of primary

colonic intussusceptions to the early years of existence is thus more marked than in the preceding three varieties

Examination of the colon at different ages reveals no such marked aggregations of lymphoid tissue as explain the origin of our other varieties of intussusception. However, a combination of anatomical conditions exists in early life which is capable of explaining this incidence. Reference to *Fig* 50 shows that the colic mucosa is thrown into folds which project into the lumen of the gut, which is relatively small. These folds are studded with numerous small lymphoid follicles. *Fig* 63, a view of the interior of the adult colon, shows that the mucosa has few folds and that the lumen of the gut is much greater than it is during early life. Any localized inflammation of such well-marked folds as exist in the specimen portrayed in *Fig* 50 would readily produce a swelling which would act precisely as an inflamed Peyer's patch in causing an intussusception. The lymphoid follicles studded over these folds would act as an excellent basis for inflammation. It is in these folds of the mucosa which are well developed that we believe the starting point of colic

FIG 63 —Interior view of an adult colon

intussusceptions is to be found. The limitation of idiopathic colic intussusceptions to childhood is readily accounted for, and the statement, if true, that the majority arise at the colonic flexures, is easily explained.

To sum up, the genesis of colic intussusception depends primarily on the relative excessive development in early life of mucosal folds studded with lymphoid follicles, and on the relatively narrow lumen of the colon, all of which peculiarities almost totally disappear by the age of seven years.* The secondary factor is, as in the case of the other varieties, some intestinal disturbance with its associated rapid change of intestinal flora. Thus there is produced, as the result of swollen lymph-nodes, an increased projection of these folds and a loss of elasticity of the œdematous overlying mucosa, simulating with more subtle mimicry, to the excited segment of bowel, a foreign body.

That sudden considerable swellings of the colonic mucosa do occur is well known, for it is a commonplace of surgical observation that the factor which converts the chronic

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* D'Arcy Power finds that at the age of fifteen the lumen of the colon has increased to between two and three times the size at birth

obstruction produced by a ring carcinoma of the colon into an acute one is an inflammatory œdema of the mucous membrane. The lumen of the carcinoma ring itself is almost always sufficient to allow of the passage of the intestinal contents.

It is needless to state the objections to perverted peristalsis and paralytic conditions of the gut wall acting as causes of intussusception in this variety. They are precisely the same as apply in the case of the other varieties.

Briefly recapitulated the theory above formulated to account for the majority of primary intussusceptions is as follows:—

1. The determining factor is the production of the equivalent of a foreign body within the intestines. This foreign body is provided by the swelling of pre-existing lymphoid tissue. The anatomical and age distribution of the lymphoid tissue in the alimentary canal agrees exactly with the anatomical and age distribution of all primary intussusceptions.

2. The factor that provokes this swelling is some gastro-intestinal disturbance. The secondary maximal incidence which occurs between five and nine months of age is accounted for by this.

3. An important accessory factor in the manufacture of primary colic intussusceptions is the narrowness of the colic lumen early in life. It is largely owing to the threefold increase in diameter of the colon at the age of fifteen that, after the age of seven years, primary colic intussusception becomes excessively rare.

We do not think that there is any one point in this theory that is entirely original and we freely acknowledge our debt to previous writers. For example, Walton has emphasized the aggregation of lymphoid tissue in the lower end of the ileum, which he rightly compares with the sacculus rotundus of the herbivora, and its relation to the frequency of ileocæcal and ileocolic intussusceptions. Fitzwilliams has pointed out the importance of the influence of the teething period, and D'Arcy Power has described the variation in the diameter of the colon with age. When all these observations are pieced together and envisaged as a whole, a tolerably complete hypothesis emerges to account for all the various phenomena of seasonal, type, and age incidence that intussusception presents.

SYMPTOMATOLOGY

Consultation of our list of cases brings a few new facts to light. Comment has already been made by other authors on the extraordinary uniformity in the symptoms of acute intussusception in children under twelve months of age. This our records fully confirm. Plump, healthy children are usually attacked with spasms of violent abdominal pain which produce screaming and drawing up of the legs. Constipation may be absolute, but sometimes the colon empties itself at the start and one or more normal motions are passed. After that, only blood and slime are seen, very occasionally accompanied by small quantities of fæcal matter as well. Both slime and blood are probably the products of the intussusceptum. Vomiting is frequent, and usually occurs during the attacks of pain.

As an example of the constancy with which these typical symptoms recur, we find that in 89 per cent of our cases the presence of blood, or of blood and slime together, are mentioned. This is a remarkable percentage when one considers that the list does not consist of carefully investigated cases with histories taken with the special view of ascertaining the typical symptoms of the disease. The histories are only those taken by the hard-worked house-surgeon during the busy period of full duty' when there is little time for accurately investigating symptoms, or at any rate for minutely recording them.

In 63 per cent of our cases* a lump was felt in the abdomen, either under the

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*The proportion of cases in which a tumour can be identified on careful examination is undoubtedly higher than our statistics show, for our series must contain many cases in which a tumour was palpable but its presence was not recorded in the notes.

Lett[15] in his carefully investigated series of 24 cases felt a tumour in every one, while Barnard gives 75 per cent, and MacAdam Eccles 80 per cent as the proportion in which a tumour can be felt.

anæsthetic or, more usually, without that a lump was sought for but not discovered, even under anæsthesia It is quite obvious that intussusceptions can be quite easily tucked away under the liver, especially at the hepatic or splenic flexures, and impossible to feel even under an anæsthetic Though more often present than not, the absence of a palpable tumour should never bias the surgeon against laparotomy in cases where a typical history points to the presence of an intussusception

In a fair number of cases specific mention is made that a lump was sought for but not discovered, even under anæsthesia It is quite obvious that intussusceptions can be quite easily tucked away under the liver, especially at the hepatic or splenic flexures, and impossible to feel even under an anæsthetic Though more often present than not, the absence of a palpable tumour should never bias the surgeon against laparotomy in cases where a typical history points to the presence of an intussusception

In one case in our records with a typical history, an intussusception concealed under the left lobe of the liver was missed at operation This shows the need for care in searching for an intussusception in the presence of a characteristic symptomatology though as a rule but little difficulty is encountered in finding the tumour once the abdomen has been opened

Our records bring to light one small point of some interest which seems to have escaped observation It is known that frequently an intussusception presents at the anus According to the different construction of ileocæcal and ileocolic varieties of intussusception one would expect that of the two the ileocæcal variety would more frequently present at the anus This is found to be the case Of the 156 ileocæcal intussusceptions, 42, or 26 9 per cent, are described as either just inside the anus or actually protruding from it Of the ileocolic, only 16 of the 126 reached a similar position, i e , 12 7 per cent In general the ileocolic intussusceptions do not progress as far down the gut, presumably owing to the obstacle presented by the ileocæcal valve, for we find 35 ileocæcal intussusceptions, i e , 22 4 per cent, reaching the splenic flexure while only 10 ileocolics i e 7 9 per cent, did the same Adding these figures together, we find that in 49 3 per cent of the ileocæcal variety the intussusception is recorded as reaching the splenic flexure or beyond, while in only 20 6 per cent of the ileocolic variety did the intussusception travel as far

It is extraordinary in the case of the ileocæcal intussusception, how soon after the onset of symptoms the valve may reach the anus It is quite common to find that after a history of 18, 16, or even 10 hours the intussusception can be felt in the rectum nor does the distance the intussusception has travelled render the prognosis necessarily bad As we shall have occasion to show, length of duration of the intussusception is the main factor in increasing mortality

Apart from this difference in the position of the lump, we are inclined to think from our own experience that the symptoms presented by patients with an ileocolic intussusception are more severe than those with an ileocæcal

General conclusions drawn from a small number of cases are proverbially dangerous, but this impression of ours derives support from a consideration of the length of the history in the two types Of the 156 ileocæcals, the length of the history was given in 101 cases and averaged 38 hours, of the 126 ileocolics, it was available in 109 cases and averaged 33 hours The difference is perhaps not great, but as far as it goes is in favour of the ileocolic intussusception producing severer symptoms than the ileocæcal In hospital practice the time at which a case is sent into hospital depends largely upon how alarming the condition of the patient appears in the eye of the practitioner and thus one would expect the ileocolic variety to present itself sooner for treatment than the ileocæcal

In practice we find that the ileocolic variety presents the following symptoms as compared with the ileocæcal the condition of the child is worse as compared with the length of duration of the symptoms, and the lump is not so far advanced It is thus frequently possible to diagnose the precise type of intussusception before opening the abdomen

In the case of the enteric variety, which, as a reference to the chart of the age incidence shown in *Fig* 57 will show, occurs more frequently in older patients, the symptoms are much less severe than in either the ileocolic or ileocæcal form In consequence, we find that the average duration of symptoms before operation is longer, viz , 84 hours Of the 27 enteric intussusceptions on our list the length of the history is recorded in 23

OPERATIVE TREATMENT OF INTUSSUSCEPTION

The following table giving the various operations that have been performed, is self-explanatory and needs but little comment The varying mortalities for the different operations merely reflect the seriousness of the condition that called for their use For example reduction with appendicectomy claims a larger number of victims than simple reduction only because the intussusceptions had existed for so long that the appendix had become gangrenous The mortality is the mortality of the condition rather than that proper to the operation

Table IV

Nature of Operation	Total	Died	Death rate per cent
Laparotomy with reduction	309	69	22 3
Reduction with appendicectomy	18	6	33 3
*Resection with anastomosis by clamps	29	20	68 9
Laparotomy Attempted reduction or anastomosis Sewn up	12	12	100
Resection with Paul s tube	12	12	100
Resection with Murphy s button	6	6	100
Paul s tube	4	4	100
No operation	7	7	100
Resection {? Paul s tube {? Anastomosis	2	2	100
	2		34 75
	400	139	

The nine cases which recovered were all over the age of three years

It is noteworthy that when an intussusception is irreducible, the only form of treat ment that has been attended with any success is excision and end-to end or side by-side anastomosis with clamps Although Dowd[16] has collected eight cases of successful resection in children under one year of age up to the end of the year 1913, the youngest patient in our series to survive excision and anastomosis was three years old The majority that lived were much older

All cases treated by drainage with a Paul s tube died either from shock shortly after the operation, or from exhaustion a few days later In one case treated by the insertion of a Paul s tube above an irreducible intussusception, the post-mortem records show that the tube was placed, not above, but below, the intussusception As far as the end result is concerned, it matters little on which side of the intussusception the tube is placed we record the incident only to show how easily this mistake may be made, and to assist the surgeon to avoid the wound to his amour propre that such a proceeding entails It would probably be safest to trace the gut from the ileocæcal valve upwards to the intussuscep tion whenever this desperate measure is the operator s only resource, as there is commonly but little distention to aid in distinguishing the proximal from the distal coil and even the anatomy of the intussusception may mislead, for there is no guarantee that a retrograde form is not being dealt with

Cases treated by anastomosis with Murphy s button yielded a like 100 per cent death rate The last anastomosis done with a Murphy s button was in 1913 Examina tion of the post mortem records show that even had the patients not died from shock shortly after the operation, the button was not likely to have relieved the condition, for, of 3 cases which came to post-mortem examination, in 2 the gut adjacent to the button was gangrenous, presumably from pressure, and in the third the anastomosis is recorded as leaking from one third of its length In all the gut above the anastomosis was much dilated

Apart from the points already enumerated, the post mortem records yield one or two hints as to operative treatment

Occurrence of Volvulus after Operation —In 2 cases, after a successful reduction,

laparotomy had to be performed again to relieve the obstruction caused by, in one case, a volvulus of the small intestine, and in another a volvulus of the large and small intestine together It is well known how often both small intestine and large have a common mesentery in young children, and care in returning the gut into the abdomen is thus indicated

Adherence of Gut to the Abdominal Incision —In 3 cases the abdomen had to be re opened owing to the adherence of small gut to the abdominal incision It has been a very general practice to sew up the abdomen with through-and-through silkworm-gut sutures with the idea of saving time and thus shock With this method it is by no means easy to make certain that no gut is caught in the wound, and we believe it is to this method of suture that this accident is due We ourselves always sew the peritoneum separately Even in small infants the peritoneum is strong and holds the stitches well, the proceeding is easy, and administration of the anæsthetic can be discontinued immediately the peritoneum is united We believe the length of time the patient is under the anæsthetic is actually less than when through-and-through sutures are employed

Gangrene of Gut after Reduction —In 10 cases of successful reduction, the post-mortem findings record that the gut was gangrenous Resection was evidently necessary , but in view of the fact that the lowest age at which a successful resection has been performed in our series is three years, and that only 8 successful cases are recorded in the literature there is obviously much to be said for leaving doubtful gut in children under this age

POST-OPERATIVE RESULTS

As a rule, after reduction, convalescence is rapid and uneventful apart from such very occasional accidents as have been mentioned in the preceding section There is, however, one feature of convalescence that does not seem to have attracted much attention and this is the very high reactionary temperature which is so frequently observed The temperature, usually subnormal on admission, commonly rises to 101° or 102°, and exceptionally to 104° or even 106° after operation

We find that 56 1 per cent of the ileocæcal and 41 9 per cent of the ileocolic type reached a temperature of 101° , 38 7 per cent of the ileocæcal and 28 2 per cent of the ileocolics a temperature of 102° after operation This temperature is far higher than that observed after ordinary operations such as radical cure for an inguinal hernia in young children It is obvious that after reduction of an intussusception there is much œdema of the gut wall which must be absorbed, and probably also other toxic products are formed in the damaged gut wall That the ileocæcal variety should exhibit more examples of a high temperature than the ileocolic is only to be anticipated, for the intussusception is as a rule more extensive and covers a larger area of gut, and thus produces more toxic bodies for absorption

It will be remembered that, while 49 3 per cent ileocæcal intussusceptions reach the splenic flexure or beyond, only 20 5 per cent ileocolics do the same In many cases it is this liberation of toxins into the blood stream which tips the patient over the razor edge which separates recovery from death

MORTALITY

Total Mortality —For the whole period of eighteen years there were 139 deaths out of the 400 cases treated, giving a percentage death-rate of 34 75

Cuthbert Wallace,[17] in his series of 20 cases, had a mortality of 20 per cent , Barker[18] a mortality of 40 per cent in a collected hospital series, and in his own series 28 per cent only , Sargent,[19] in a series collected from St Thomas's Hospital Reports, 61 per cent

The subsequent discussion on operative results will show, however, that the factor on which the mortality of any series depends is less the skill of the operator than the length of the history before operation is performed Thus 21 cases of intussusception were operated on at the London Hospital in the year 1915 by eleven different surgeons with a mortality of only 14 3 per cent The excellence of this result was due to early diagnosis

Sex.—As is only to be anticipated, the mortality is practically the same for both sexes. Of males, 93 died of a total of 272, giving a death-rate of 34·1 per cent, while 46 females died out of a total of 128, giving a death rate of 35·9 per cent.

Mortality in Relation to Type.—Table V gives the mortality in the case of each type.—

Table V

TYPE OF DISEASE	TOTAL CASES	NO. OF DEATHS	MORTALITY PER CENT
Enteric	27	15	55·5
Ileocæcal	156	51	32·6
Ileocolic	126	39	30·0
Colic	19	3	15·7

It is seen that the mortality is highest in the case of the enteric, and lowest in the case of the colic variety, the ileocæcal and ileocolic varieties occupying an intermediate position.

At first we were inclined to think that the explanation of this curious difference lay in the readiness or otherwise of each form of intussusception to become irreducible. It is tempting to suppose that, owing to the greater diameter of the colon, a colonic intussusceptum has less tendency to be tightly gripped and thus form adhesions between the entering and returning layers than an enteric. The low mortality of the ileocolic variety, however, definitely negatived this hypothesis, for the pressure upon the intussusceptum should be just as severe in this type as in the pure enteric. An examination of the symptomatology of the various types provided, however, the key to the puzzle. As already mentioned in the section on symptomatology, the average length of history in the four types is as follows:—

| Enteric | 84 hours | Ileocolic | 33 hours |
| Ileocæcal | 38 | Colic | 33 |

Thus the mortality runs precisely parallel with the length of the history, and the curious paradox manifests itself that the type of intussusception which produces the milder symptoms is ultimately the most fatal, for it remains longer unrecognized, and thus time is given for it to become irreducible through the formation of adhesions. An accessory factor in the production of the high mortality of the enteric intussusception is the difficulty in feeling a lump, for in only 8 of the 27 enteric intussusceptions was a lump felt, while in 14 of the 19 colic intussusceptions the tumour formed by the intussusception was identified. The percentages are 28·5 and 73·6 respectively. The following table gives the total number of cases, mortality, length of history, number of resections, and percentage of cases in which a tumour was felt respectively:—

Table VI

VARIETY	NO. OF CASES	MORTALITY PER CENT	LENGTH OF HISTORY	RESECTIONS	TUMOUR PER CENT
Enteric	27	55·5	84 hrs	16	28·5
Ileocæcal	156	32·6	38	14	74·3
Ileocolic	126	30·0	33	11	59·5
Colic	19	15·7	33	1	73·0

It will be observed that a perfect parallel is preserved between each of the four last columns. It is incidentally worthy of note that every death among the enteric

intussusceptions followed a resection There were 16 resections in all 1 recovered, 15 died On the other hand, each of the 12 cases in which the intussusception was reduced recovered

Triennial Mortality—*Table VII* gives a comparison of the mortality for each triennial period of the eighteen years surveyed —

Table VII

YEAR	TOTAL CASES	DEATHS	MORTALITY PER CENT
1903–05	74	42	56 7
1906–08	64	26	40 6
1909–11	68	23	33 8
1912–14	81	18	20 9
1915–17	67	12	17 9
1918–20	46	18	39 1

The steady fall in the death-rate is a most astonishing feature of this table and the rise for the last triennial period is almost equally remarkable As the treatment throughout these eighteen years has been without exception operative, either operative technique or diagnosis must have improved to account for this diminution in mortality Tables compiled from the registers of the operating theatres show that the average time occupied in performing the same kind of operation in the later is no less than that occupied in the earlier years Surgeons were as skilful in 1903 as in 1915 Increase in operative skill cannot therefore account for the reduction in the death-rate, and we are driven to seek some other explanation

A comparison of the average length of the history before the patient reached the operating table supplied the clue to the problem *Table VIII* gives the total mortality for each of the triennial periods the average length of the history for all the cases of each triennial period in which such could be obtained, and also the percentage mortality in those same cases

Table VIII

YEAR	TOTAL CASES	TOTAL DEATH RATE	NO OF CASES IN WHICH DURATION WAS ERACTABLE	MORTALITY PER CENT	LENGTH OF HISTORY IN HOURS	RESECTIONS
1903–05	74	56 7	61	59	46	14
1906–08	64	40 6	42	38	35 8	12
1909–11	68	33 8	39	27 9	33	12
1912–14	81	20 9	55	20	29	11
1915–17	67	17 9	46	19 5	26	2
1918–20	46	39 1	32	26 5	32	7
Totals	400		275			

It is seen that the resemblance of the two sets of figures is very close The percentage death rate for the cases in which the average length of the history can be ascertained is slightly different from that for all the cases admitted during the same period, but there is not much discrepancy and the death-rate varies as regularly with the rise or fall in the length of the history in the one set as in the other The obvious explanation of the change in the death-rate is to be sought in the answer to the question why the length of the history varies

Several hypotheses suggested themselves, only to be rejected on consideration, and

the conclusion finally reached is that the outside practitioner is probably responsible for the varying periods at which the patients are sent up to the hospital From 1903 to 1917 the steady improvement in the statistics is probably due mainly to increase in the number of doctors available for attending the population around the hospital, and possibly also to improved education It must be remembered that rectal injections as a treatment for intussusception have only ceased to be carried out in the last twenty years,[*] and thus after this date there must have been many practitioners surviving who from early training failed to appreciate the need for early operative intervention With the passage of time their views would have gradually changed until the present attitude of mind would have been universally reached, in which any child with diarrhœa and vomiting is regarded with a suspicious eye as a possible sufferer from an acute intussusception The regrettable increase in the mortality during the last triennial period, 1918–1920, is probably due to the extensive withdrawal of doctors for the army during the latter part of 1917 and early months of 1918 This has probably righted itself at the time of writing (December 1920), but the more favourable statistics of 1920 have not made themselves felt, for they are not completely incorporated in this last triennial period as only the first 7 cases admitted in 1920 are included in the series in order to keep the total number considered at the round figure of 400

Possibilities of failure in the hospital organization for the treatment of emergencies were carefully reviewed by us, but none manifested themselves By hook or by crook, the most expert surgical assistance was always available throughout the war for civilian patients, and throughout the whole of the eighteen years surveyed an intussusception has always been regarded and treated as a surgical emergency requiring immediate relief

Consideration of the varying mortality during the eighteen years thus shows that it lies in the hands of the practitioner to reduce the mortality of acute intussusception from 56 7 per cent to 17 9 per cent by early diagnosis of the condition Comparison of the best and the worst individual years of our series yields an even more remarkable difference still In 1903, 21 cases were treated, of which 13 died In 1915, 21 cases were also treated, of which only 3 died The difference in the mortality is that of 61 9 per cent as compared with 14 2 per cent, or, in other words, 10 more good lives were saved in 1915 than in 1903

LITERATURE

We have only appended a list of those papers to which actual reference has been made in the text, though many more have been consulted A short account of a few of the points gleaned may be of interest The most important early paper we can find is Leichtenstern's monograph in the *Prager Vierteljahresschrift* As one of many good things, he gives a most complete list of literature, which even then was immense, up to the date of writing, 1873 It is interesting to note that, with characteristic Teutonic thoroughness he refers to Fabricius Hildanus's[21] paper on prolapse of the uterus written in 1676 In John Hunter s[22] paper, it is of some interest to note that he styles intussusception 'introsuscep tion' Rokitansky[23] is responsible for the change of the term to intussusception, and the introduction of the terms intussusceptum and intussuscipiens Sir Jonathan Hutchin son, in 1873, records the first successful case of laparotomy in Britain, one performed by himself and cites others, notably one performed in 1874 He says intussusception was diagnosed by Nuck, at whose suggestion operation was performed, in the performance of this operation the intestines were fomented with tepid milk and the intussuscepted part was well oiled It is spoken of as having been very easy of performance " The lady recovered A most interesting series of cases collected by Waren Tay is appended, among which we read that during the treatment of intussusception in a child age 4,

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[*] In this connection it is interesting to note that as late as 1910 in the discussion on a paper by Childe in the *Trans Soc Med*, July 1910 a well known practitioner makes the statement I have used inflation in all my cases, and with satisfactory results '

" clysters had no effect   Aftei eight pumpings with the bellows a loud icpoit was heud   The next day there were signs of the tumoui returning, but the whole disappeaied aftei inflation '

Corner's papei[24] contains the most detailed system of nomenclatuic foi compound intussusceptions we have discoveied

For the hteratuie after Leichtenstern's time, Waltons admuable article in the *Piactitionei*[25] should be consulted

We beg to tender our thanks to manv of our colleagues for their helpful suggestions , to Mr A J Walton for his valuable assistance in the voluminous hteratuie of the subject to Mr William Morris for his kindness in elaboiating the diagiams, and to Di W W Woods of the London Hospital Pathological Institute, for his help in the picparation of sections

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the left hypochondrium (Fig 64, b) was next enlarged and some three quarts (3 litres) of pus, mixed with decomposing blood, evacuated   Further exploration revealed a hard mass consisting of portions of bone and cartilage, undergoing maceration   In addition hair and a flesh-like mass could be detected, and a piece of bone free in the cavity, which was removed   This piece of bone resembled a fœtal tibia and fibula   Nothing further was done at the time, except to insert a large drainage tube

As soon as the patient had recovered from the anæsthetic and the operation, an x ray photograph was taken, and this revealed a bony and cartilaginous mass, suggesting a partially calcified fœtus

On Aug 2 a further operation was undertaken, the abscess cavity in the left hypo chondrium being thoroughly opened up, and all the fœtal contents removed   The cavity was sponged out and packed   The patient did not stand the operation at all well, and there was no improvement   Death occurred on Aug 18

Post-mortem Examination (J A B H)—The patient was greatly emaciated, and presented the scars and sinuses already enumerated

THORAX —Right lung showed nothing noteworthy, but the left lung was firmly adherent to the diaphragm and lower part of the pleural sac   Two sinuses led into the left pleural sac, one from the skin in the region of the 9th rib posteriorly (Fig 64 c), and the other, never discovered during life, from the pleural sac into the abscess cavity in the left hypochondrium   This latter sinus passed through the diaphragm, and indicates that the empyema was secondary to the abdominal abscess

Heart   Nothing noteworthy

Weights   Right lung, 9 oz   Left lung, 12 oz   Heart, 8 oz

ABDOMEN —With the exception of changes due to prolonged fever and suppuration, the liver and kidneys showed nothing noteworthy   There was no evidence of lardaceous disease   The gastro-intestinal tract was normal, and the whole of the abscess cavity, to be described later on, was retroperitoneal, the actual peritoneal cavity itself being quite clean and free from adhesions   Ureters and bladder, nil   The pancreas was present but all efforts to trace the spleen failed   The uterus and both ovaries were present and normal

Weights   Liver, 47 oz , kidneys, 3 oz each

CYST AND CONTENTS —Occupying the left hypochondrium, and placed well away under the rib margins was an ovoid cavity   The dimensions of this cavity were 7 in (18 cm) in one of the diameters, and 5–6 in (13–15 cm) in the other   The wall of this cavity was placed entirely behind the parietal peritoneum   The lower pole was just in front of the upper fourth of the left kidney, from which, however, it was easily separable   The inner side of the sac was in close relation to the tail of the pancreas, from which it could be readily stripped off   The anterior aspect was firmly united to the under surface of the lower ribs, and to the abdominal wall just below their margins , while the upper and posterior aspects of the sac were formed by the left cupola of the diaphragm   Through the diaphragm passed a sinus leading into the left pleural sac, which has been already mentioned   The wall of the sac was uniformly about 4 mm thick, and the inner surface presented a somewhat skin-like appearance, being everywhere coated with a layer of pus

Microscopically, the wall of the sac was found to be composed mainly of condensed fibrous tissue   in a few places, however, true skin with sebaceous glands and hair follicles was present

The contents in life of this sac were   (1) Pus , (2) Matted strands of long hair , (3) Fat and sebaceous material , (4) The teratomatous mass

The first three need no particular discussion

The teratomatous mass was in an advanced state of development, as can be seen from the photograph (Fig 65) which should be compared with the skiagram (Fig 66)   The specimen studied thus seems to show a narrower portion, which might be a femur, to which are attached about three digits   It will be remembered that bones resembling a tibia and fibula were removed from the cyst, but they were unfortunately lost   About

the middle is a sort of pelvis then a rod of bone enlarging into an irregular mass of bone like a crocodile's head   Coming off from the middle of the larger mass is a pedunculated structure, also containing bone   The coverings of both these masses are skin with the appendages and a ball-like mass of long hair matted together by sebaceous material   No dissection has been attempted, as such a course would have of necessity spoilt the specimen and we doubt very much if any scientific gain would have been achieved

This cyst containing foetal elements would seem to be an example of a teratomatous cyst arising in an unusual situation   Similar examples have been recorded, but the condition is of such rarity that the publication of the case seems to us to be justified There is no reason why a teratomatous cyst should not arise in this situation, if the theory of origin as 'mistakes' in development of tissues derived from the germinal area of the mesoblast is accepted   In the foetus, a large mass of mesoblastic tissue exists in the renal region, at first undifferentiated, it is later split off into ovarian (or testicular) and renal tissue   The ovarian (or testicular) portion later descends into the pelvis, and it is not beyond our imagination to accept the theory that a teratoma such as this is the result of some of the germinal area being left behind when the descent into the pelvis occurs What starts the growth of such a mass of cells into an imitation of foetal structure such as this and other teratomata is unknown   The extraperitoneal situation of the cyst in close relation to the left kidney and to the spleen, which apparently it had obliterated since this organ could not be found, supports the views enunciated above   The suggestion that it might be an ectopic gestation is negatived by   (1) The presence of absolutely normal uterus and appendages, (2) The situation of the cyst, (3) The contents—a mass of hair—many of the individual hairs being some inches in length, (4) Normal and uneventful pregnancies since the lump in the left hypochondrium was originally felt (first in 1900 last pregnancy in 1912), (5) The integrity of both ovaries further shows that the teratomatous cyst did not arise in either of these organs, and subsequently became dissociated and displaced into the splenic region, (6) The formation differs from retroperitoneal forms of foetus in foetu or ischisis foetatis *var* abdominalis in that the enveloping sac consists in part of true skin which has evidently produced the long hairs shed into the cavity

Looking back on the case, it seems that before suppuration supervened the cyst might have been removed more easily than an adherent enlarged spleen, because of the absence of large vascular connections

TUMOURS OF THE SALIVARY GLANDS, WITH THEIR AFTER-HISTORY *

By R KENNON LIVERPOOL

SALIVARY-GLAND tumours though not of frequent occurrence, share with sebaceous cysts and ganglion a peculiar power to elicit in their possessors a morbid delight in their presence, with its attendant self-pity   This, with the luxury of an ever sympathetic group of friends   makes them blind to the hideousness of their deformity and deaf to the warnings of the profession as to the ultimate outcome of this silent death   The knowledge of surgical failures, in patient and doctor alike, has weakened the demand for treatment and the object of this research was to investigate the after-history   causes of recurrence, and the pathological nature of salivary tumours, and to demonstrate that, in the majority of cases, surgery can cure

The material consisted of 124 cases of parotid tumours and 13 cases of submaxillary tumours, collected from the Thompson Yates Pathological Laboratory and the records of the Royal Infirmary

The 124 cases of parotid tumour were classified as follows   *Adenomata*, 91 cases, including a case of lymphangioma and one of inflammatory origin   *Carcinomata*, 27 cases   *Sarcomata*   6 cases

ADENOMATA

Out of the 91 cases of simple tumour, the after-history of 32 has been traced   of these, 29 were operated upon over five years ago   Of the 32 cases in which an after history was obtained   22 are alive and well , 1 died of an unknown cause, 1 died of angina pectoris without recurrence seven years after the operation , 5 have recurred , 3 under the five-year limit are also alive and well   In other words, 71 9 per cent have survived the five-year limit, while 15 6 per cent have recurred   The average duration of known cure was well over eleven years

ETIOLOGY —The age at the onset of disease (data available in 29 cases) averaged 30 1 years (youngest 16 years, oldest 54)   Age at the time of operation (43 cases) 37 years (youngest a case of lymphangioma age 13, another age 15)

It is interesting to note that the persuasive influence for good of a doctor over his patient in these cases varies from 9 months to 20 years, and averages 7 years   Out of 78 cases 59 occurred in women, 19 in men   No family history of similar tumours was obtained

Trauma —Out of 29 cases in which a record is available, 4 gave a previous history of blows on the cheek etc   Mumps, scarlet fever with tonsillectomy   figure in individual cases

PATHOLOGY —Macroscopically the tumour is lobulated, partly solid and partly cystic   occurring on either side of the face without much distinction (left 21, right 27)   bilateral in two cases   multiple in one   The heaviest recorded weight was 3 lb 10 oz , removed by Mr Rushton Parker   but at that time malignant change had probably taken place and early and repeated recurrence followed (*Fig* 67)   Keen reported a case in which the tumour weighed 7 lb

Much has been written on the origin of these tumours, and their terminology has changed with the prevailing pathological whim   they have been styled mixed tumours

endotheliomata, embryomata, teratoblastomata   The amount of indefinite evidence for these names contrasts vividly with the decided opinion I obtained from Mr Paul and Mr Thelwall Thomas that primarily the lesion is an adenoma   Examination of over seventy sections leads me to agree with them, and I recognize two types   *the diffuse* and *the acinar*

Fig 67 — Adenoma of 37 years duration weight 3 lb 10 oz , removed by Mr Rushton Parker   Finally carcinoma ensued

The diffuse type is illustrated in the case of Miss J M (*Fig* 68), who noticed a swelling on the left side of the face at the age of 51   Two years later Nov 1909, it was removed by Mr R A Bickersteth   In July, 1920, she was alive and well [2313]   It is also illustrated by *Fig* 69, a recent case , this tumour was removed by Mr R E Kelly
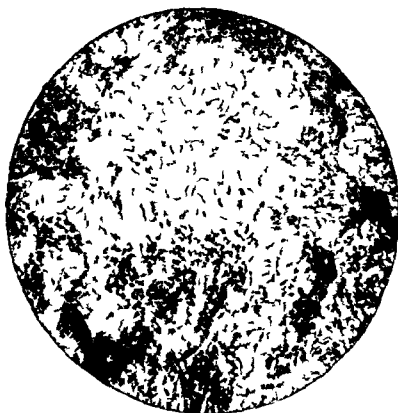
Fig 68 —Diffuse type onset at age of 51 removed two years after 1909 alive and well 1920
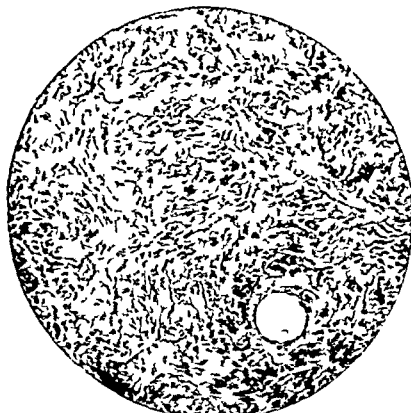
Fig 69 —A similar case to that in *Fig* 68, but more recent

The acinar type is shown in *Fig* 70—Miss D B   age 19, a recent case of typical 'mixed tumour , removed by Mr Litler Jones   For a time I was disposed to think the latter were of duct origin, while the former arose from gland proper , but closer study showed that both diffuse and acinar formations occur in the same tumour   Frazer[1] believes these tumours are duct adenomata   The course of events seems to be an adenoma

mucinous degeneration with epithelial or degenerative cyst formation, inspissation or liquefaction, necrosis, and later, formation of cartilage In innocent growths I did not find any outer layer of basal cells though such is present in many cases of cancer The anatomical view that the cartilage is derived from branchial clefts has little evidence to support it Purely bone or cartilaginous tumours do not occur in this series, and sarcomata form only 5 per cent of the malignant cases

The endotheliomatous origin of these tumours I have not dealt with, but endothelium can often be seen in the smaller blood-vessels and the capillaries presenting no atypical appearance To support this theory of origin it is necessary to imagine a flat scale like cell under an unknown stimulus, changing into a sphere or cube and, though derived from mesoblast, capable of producing carcinoma in the majority of cases when malignancy ensues and one must imagine also a differential stimulus capable of exciting to over growth the ill-defined and little-known perivascular endothelium, yet leaving intact that of the normal blood-vessels and capillaries

Fig 71 shows an adenoma with well-defined acini, distended with mucus, removed from Miss N , age 50 at time of operation, by Mr Thomas in December 1912 Reported ' quite successful , November 1920 [1991]

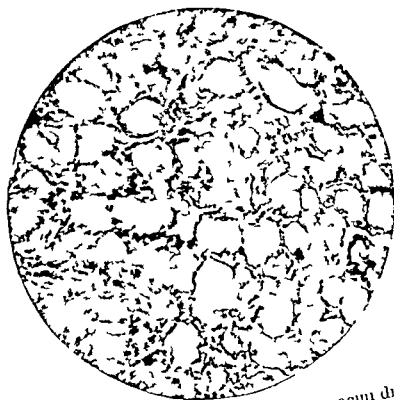IIG 70 —Acinar type of parotid adenoma at age of 19 Recent case

IIG 71 —A similar case to Fig 70 acini distended with mucus

Fig 72 shows the second stage of the diffuse mass, mucinous degeneration, from D J , male, age 41, in 1907 The tumour appeared in 1901 on the right side of the face It was removed nine months later and diagnosed cancer It recurred, and was again removed in 1904, with immediate recurrence Yet simple enucleation in 1907 by Mr Bickersteth was so successful that in June, 1920, the patient wrote ' I regard myself as being completely cured —a fact discrediting the idea that operative interference favours recurrence and shortens the life of the patient

SYMPTOMS AND SIGNS —A painless, slowly-growing swelling at the angle of the jaw If pain is present then, microscopically, a superadded inflammation is present The slow growth is very characteristic, but 7 cases complained of recent sudden increase which evidently caused alarm In these cases no malignant change had occurred , possibly the capsule had been so thinned as to yield, and liberate the cells from their constrained position beneath—a point I shall refer to in dealing with the pathology of recurrence The lobule of the ear is early displaced outwards, but mental obstruction is rare—one case in our series which was relieved by syringing Later, redness and ulceration of the skin occur The lymphatic glands are not enlarged except from other diseases Facial paralysis is unrecorded except as a post operative event or with the onset of carcinoma

TREATMENT —The situation of these tumours renders operation in any great enlargement a formidable proceeding and the records show evidences of great difficulties from

the operator's point of view —ligation of the external or internal carotid arteries, or both, with the internal jugular vein or the common carotid artery, had to be performed so frequently in the middle of the operation that ligation of the external carotid should be a useful preliminary in all cases of great enlargement

The type of incision must vary with the size and position of the tumour One patient complained of the incision which swings round the jaw half an inch from it—she was evidently troubled with the anæsthesia and hyperæsthesia due to division of the branches of the great auricular nerve An incision described by Ochsner[2] would avoid this complication, the incision commences midway between the lobule of the ear and the angle of the mouth, and swings downwards and gradually backwards to about half an inch below the angle of the jaw

Seven post operative cases of facial paralysis occurred, of which 6 have been traced, and with one exception no mention is made of this disfigurement so that I am forced to believe that the tension relaxation of this nerve by removal of the tumour produces more cases of facial paralysis than the surgeon's knife No cases of salivary fistula have occurred Treatment with spirit biniodide, scraping of imperfectly-removed tissue to express or kill any liberated cells, do not seem to influence recurrence, but are safeguards of great comfort to the operator

FIG 72 —Mucinou degeneration of the diffuse type

FIG 73 —Mode of growth and cause of recurrence Capsule splitting by healthy cells Note inflammatory reaction which caused pain

Recurrence—Apart from the incomplete removal of very large adenomata and the development of malignancy in a simple tumour (*see* later), recurrence took place in 9 out of 32 cases traced, i e, 28 1 per cent Three patients still possess their tumour and hesitate to undergo further operative treatment, 2 are being controlled by radium, 3 recurrent cases (one the lymphangioma) are cured if the five-year limit be accepted, another is alive and well but within this limit Immediate recurrence occurred in 5 out of 9 cases in which accurate history is available Re-operation time averages five years in 11 other cases

An examination of the sections of 70 cases of adenoma shows that the epithelial cells persist longest either in the extreme centre of the degenerate mass, probably around a blood-vessel, or, what is more important from the surgical point of view, immediately beneath the ever-thinning capsule Even in the most degenerate tumour, small elongated groups of cells will be detected splitting the layers of the capsule and leading a more healthy existence than in the rest of the tumour

If the surgeon enucleate the adenoma rather than excise it he may inadvertently split the capsule liberate the soft epithelial cells contained between its layers, and run the risk of recurrence unless treatment with cautery or strong antiseptic be employed This process of capsule splitting seems to be the method of growth during life and in *Fig* 73

we see both recent splitting and resulting inflammatory reaction in the effort to stem the progress of tumour formation   Judd also refers to this in the *Mayo Clinics,* 1910   The figure is from E M, female, age 48 at time of onset   Two years later a painful tumour fixed by inflammation was enucleated, in 1913   By 1920 no recurrence had taken place, and there was 'no disfigurement , for which she is duly grateful to Mr Bickersteth

AFTER HISTORIES OF 32 CASES OF ADENOMA

Case 1—Mrs A P, age 31   History of mumps [7901]   Tumour noticed, 1911   Typical mixed tumour   removed 1913   Recurrence, removed, 1916   Immediate recurrence, and incomplete operation August, 1917   ' Ordinary type of parotid tumour, apparently not malignant '   Oct 27, 1920   Husband writes operation a complete failure   she is   under treatment of some sort at Carnarvon to lift the tumour and not the roots "   Life history of tumour to date, nine years—a surgical failure

Case 2—Miss S J R [3357]   Tumour appeared at side at the age of 27, and was excised at Wrexham   Recurred seven years later   Mr Thomas removed it five years later, Nov 22, 1917   Reported   quite successful ' on May 23, 1920

Case 3—Mrs A N [2699]   Age 35 when tumour appeared on right side in 1899   Removed after recent rapid growth 1915   Report, May 23, 1920,   Very grateful to Mr Thomas not only for the operation   but for saving my face from being drawn '

Case 4—Mr R J, at the age of 24, noticed tumour with aching pain   Removed July 29, 1910   Quite a success for a number of years— now is large as ever (due in some mystical way to army life)

Case 5—Miss N [1991]   Age 50 at time of operation by Mr Thomas, December, 1912   Nov 5 1920   Quite successful   Mucous adenoma (*see Fig* 71)

Case 6—Ellen McT   After 10 years' delay tumour was removed by Mr Paul in February, 1906   Dec 2, 1920   Alive and well

Case 7—Kitty C   Noticed tumour at age of 21   Nine years later it was enucleated, Feb 19, 1907   Feb 10, 1920   A complete success, thanks to Mr Paul

Case 8—Miss W [1178]   Age 38 at time of operation by Mr Thomas on April 30, 1910   Left side   July 5, 1920   Dr O Evans reports alive and well

Case 9—Miss O B [1105]   Age 30 at time of onset   Operation two years later by Mr Thomas, left side, Feb 2, 1910   Tumour an inspissated cell less mass of degenerated tissue   Dr O J Evans reports her alive and well on July 5, 1920

Case 10—Rev G [648]   Age 50 at time of operation   Enucleated by Mr Thomas April 18, 1909   Died in 1915 of angina pectoris   No recurrence   Dr Arkle

Case 11—Mr J H [6753]   Age 64 at time of operation by Mr Kelly September 1915   Complete success   and thanks the operator on Nov 4, 1920

Case 12—Miss M T [2776]   At the age of 25 tumour appeared on right side   Came suddenly and was painful   ' Remembers straining jaw "   Removed three years later by Mr Thomas in 1915   Writes on May 27, 1920, result   quite satisfactory '

Case 13—Mr E J   Age 23 when operated upon, Nov 23, 1904, by Mr Paul whose pathological diagnosis was adenoma   No trouble since   Dec 18, 1920   Very grateful to Mr Paul and infirmary staff   Note   16 years without recurrence

Case 14—Mrs A [998] —First operated upon in 1903 at the age of 56   Had a recurrence and was again operated upon in October, 1909 by Mr Thomas   Dr Marsden writes,   Now 74 years of age and in the best of health "   A pathologist reported cancer in 1909

Case 15—Mr J E J   Recurrent tumour removed by Mr Rushton Parker, Jan 31, 1907   Nov 10, 1920   Successful in every way " for 13 years

Case 16—Mrs M K   Developed a tumour at age of 31   Removed by Mr Bickersteth five years later March 22, 1909   In May 1920, alive and well

Case 17—Mrs H [587]   Operated upon by Mr Thomas on Feb 11, 1908   Dr Nixon reports alive and well on June 29, 1920   and adds a useful research note that this had been the only case in his practice

Case 18—Miss Jessie T [3057]   Age 21 at time of operation by Mr Thomas in December, 1916   Left side   May 11, 1920   Is very glad she had it removed   No recurrence

Case 19 —Mrs J M [2313]   Tumour appeared at age of 51   Left side   Two years later, on Oct 1, 1909, it was removed by Mr Bickersteth   Report on July 18 1920, says ' Quite all right since the operation"

Case 20 —Mrs E M [4765]   Age 48 at onset   two years later tumour removed by Mr Bickersteth, in 1913 (*Fig* 73)

Case 21 —Mr D J [5394]   *Fig* 72 (*see* text, p 78)

Case 22 —W E [1476]   Age 25 when tumour appeared in 1905   Removed by Mr Thomas in 1911   Dr Arthur Walker reports alive and well, July 8, 1920

Case 23 —M M [2951]   Multiple recurrence—tumour still present   In 1911 this patient at the age of 52, developed a tumour which was removed the same year at West Hartlepool   In 1912 it had recurred and was removed at the Royal Infirmary   In 1914 it recurred again and was removed   In 1919 a recurrence was treated with radium by Dr Holland   Total duration of the disease is eleven years to date

Case 24 —Miss A L   Now married, with children   At the age of 27 had an adenoma removed   It recurred in 1909 and cancer was suspected, but there is no histological evidence of this   Dr Carse reports that recently it has again recurred, and he is hoping to obtain further surgical treatment

Case 25 —J G [5859]   Trauma fifteen months previously   Tumour removed, April 27 1914   Recurred February 1916   Removed January 1917   Recurred, radium prescribed, and said to be cured   Recurred, April, 1919   Attends monthly for radium and has improved sufficiently to seek a higher post   she speaks in generous terms of the treatment

Case 26 —W H   Appeared at age of 30—operated upon by Mr Kelly five years later   Middle of 1920, alive and well

Case 27 —J J [162]   Tumour appeared at age of 31   In January, 1905, tumour was enucleated by Mr Paul   Fifteen years later, Dec 10, 1920, was alive and well

Case 28 —Miss McC   Age 30 at time of operation in 1915   Died 1 year later, cause unknown

Case 29 —Miss M B , age 43 at time of operation, Jan 1 1917   Alive and well, Nov 8, 1920

Case 30 —Miss M P T   At age of 20 noticed swelling on right side of face   Enucleated Dec 3, 1917—eight years later   Alive and well, May, 1920

Case 31 —Miss M B , age 13   Operated upon for 'cystic lymphangioma in 1892   Recurred and was removed in 1895, and again in 1897   Since then alive and well, 1920   Mr Rushton Parker

Case 32 —Miss P W [1710]   Age 40 at time of operation by Mr Thomas   A chronic inflammatory thickening of parotid gland   Excised and cured

Case 33 (too late for inclusion) —Mr E E   Age at onset 71   Operation three years later   Died one year afterwards from 'cystitis'   No recurrence

Case 34 (too late for inclusion) —Mr G E   Age at time of operation 25 , tumour removed by Mr Rushton Parker 1892   Alive and well March, 1921

CARCINOMA

Of the total 124 cases, 27 (21 8 per cent) were carcinomatous on section   Of these, 5 cases were traced and 2 others are known to have inoperable recurrences   The histological appearances, supported in 4 cases by the clinical history, suggest that carcinoma was engrafted on a simple tumour in 7 out of 20 cases (35 per cent)

Age —Excluding cases arising as simple adenomata, the average age is 46 4, sixteen years later than the adenoma   The malignant change in adenomata appears to occur about the 38th year   The average operation age is 48 1 years   The delay of 1½ years (5 cases) is less than in simple tumours, but still significant

Sex —Again the preponderance of females to males is noticeable—12 to 8

Trauma occurred in 2 out of 12 histories   One patient played a wind instrument

Pathology —Two types can be recognized   (1) *Spheroidal-celled cancer*   (2) *Adeno-carcinoma*, in which the cells are more cubical   Of the primary cases, examination of the sections shows 9 spheroidal-celled cancer (*Fig* 74) and adenocarcinoma (cubical-celled) (*Fig* 75)   Those deemed to arise in simple adenomata show 4 spheroidal-celled cancer and 3 adenocarcinoma (cubical celled)

Fig 74 —Mrs J R Patient of Mr Thomas Onset at age 49, with pain Twelve months later the size of a Tangerine orange Growth encapsuled—removed August 1917 Recurred in glands Removed, March, 1918 Again recurred in August, 1918, and glands showed spheroidal celled cancer Later history unknown, but no reply to so recent a case is significant
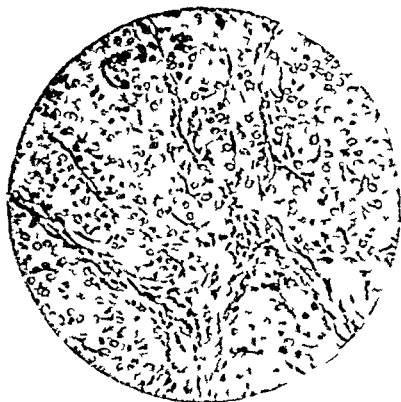

FIG 74 —Spheroidal celled carcinoma

FIG 75 —Cubical celled adenocarcinoma

Fig 75 —Miss L B Age 32 at onset in 1911 Tumour on left side of face adherent to external jugular vein, within one year had caused facial paralysis Removed by Mr Thomas in January, 1912 A cubical celled carcinoma with marked inflammatory reaction Dr Pethick writes that growth recurred locally and orbit became involved Patient died in August, 1917 Radium failed to relieve

The histological features are the well-defined basal layer, the healthy and highly-organized stroma, the small amount of degeneration (*Fig* 76 Miss V, age 20 Mr Pauls case, history unknown), and the more marked inflammatory reaction of the tissues, with direct infiltration of parotid tissue
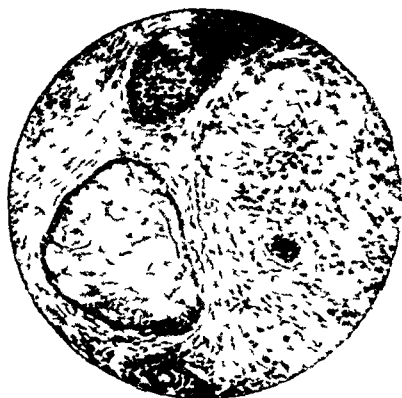
FIG 76 —Spheroidal celled carcinoma with small areas of mucous degeneration

SYMPTOMS AND SIGNS —

1 Rapid growth

2 Pain at onset or within a few months, in eye or ear in 7 out of 11 cases

3 Facial paralysis Four out of 11 cases prior to operation, 3 cases after operation, one of the latter known to have been permanent

4 Early fixation of tumour, interference with jaw movements, occlusion of external auditory meatus invasion of the orbit, with subsequent blindness, occlusion of pharynx depression of palate, ulceration of skin and secondary hæmorrhage in all cases recorded in this small group Involvement of lymphatic glands is late in occurrence, and often the site of post-operative recurrence

RESULTS OF TREATMENT —

Mr McB —Died 1 year after last operation Primarily simple, duration 12 years (*See Fig* 78)

Mr C —Died 4 years after last operation Primarily simple, duration 17 years

Mr K —Probably died Inoperable four years after last operation Primarily simple, duration 45 years

Miss F L —Primarily simple, 3 years' duration Now 15 months since complete excision by Mr Litler Jones Alive and well, no local recurrence, but similar tumour on opposite side has progressed—this was present at time of operation

Mrs E F—Died 5 years after operation   Primarily simple, duration 10 years
Mr C S—Inoperable, 2 years after operation   Recurrence   Previous operation 6 years ago
Miss L B—Died 3 years after an operation, total duration 1½ years
Mr J C—Died 2 years after an operation, duration 4 years

The average duration of primary cases seems to be about 4 years

CASE RECORDS

Mrs E F—Age 35 at onset of growth, constant pain in right ear   Five years later Mr Latler Jones had the unenviable task of an incomplete removal in November 1912—the ady the glands were involved   The patient died, writes Dr Williams in 1917   (*Fig 77*)

Mr P McB—A case of carcinomatous change in a simple tumour   Onset at age of 51   Twelve years later, 1910, recent pain brought patient to the surgeon   The tumour was then 6 in in diameter, and facial paralysis was present   The common carotid and external and internal jugular veins had to be tied and the sternomastoid divided   (*Fig 78*)

FIG 77—Adenocarcinoma in a primarily simple tumour invading parotid tissue
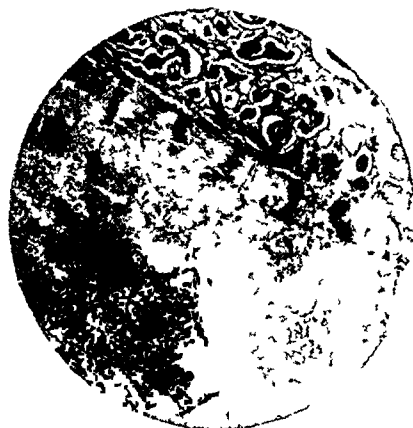
FIG 78—Similar case to *Fig 77*

Mr W C—Onset prior to 1891, when patient was operated upon at age of 37   A recurrence took place, and 12 years later a second operation, followed a year later by a third   His son writes that patient passed away in great pain, and the throat had become closed entirely, in 1907

Mr W K—Onset at the age of 16   Tumour weighing 3 lb 10 oz—the largest of the series—removed by Mr Parker 37 years later, in 1900   In 1905 recurrence and removal, again in 1906 declared inoperable in 1908   No reply to inquiries, 1920   Section shows a simple adenoma becoming malignant in 1900

Miss F L [9935]—Age 49 at onset of growth   inflamed for 4 months (painful)   Bilateral Total excision of the tumour on the left side 3 years later, in 1919, that on the right has continued to grow   Left facial paralysis is present (post operative) Jan 16, 1921   Section shows huge cystadenomata, cartilage and areas of subcapsular round celled inflammation, but in associated gland showed columnar celled carcinoma   Total excision by Mr Latler Jones   so far successful, 15 months after operation

Mr C S—Age 46 at first operation, 1912   Recurred and removed 4 years later   Recurred and inoperable, August, 1918   No reply from M O

Mr J C—Age 61 at onset of swelling in right parotid region   rapid growth, with local pain Two years later an unsatisfactory removal by Mr Kelly in January, 1914,   Died February, 1916, from the disease   Columnar celled cancer

SARCOMATA

Six cases in 124   3 females, 2 males, 1 doubtful   Of these, one case only was traced Ages of patients   20, 44, 70, 55

PATHOLOGY—The usual round- or spindle-celled varieties

CLINICAL FEATURES—Sudden pain, facial paralysis, discharge from the ear, difficulty in opening the mouth, pharyngeal obstruction, are recorded

Radium was used in one case, end-result unknown, patient could not be traced

A sarcoma, spindle celled, with alveolar formation, occurred in a patient, J D, a woman, age 55 After three years it was the size of a walnut, had produced facial paralysis, and involved glands Total excision with an area of skin by Mr Thomas in January, 1917, failed

Fig 79 —Alveolar sarcoma facial paralysis and involved glands
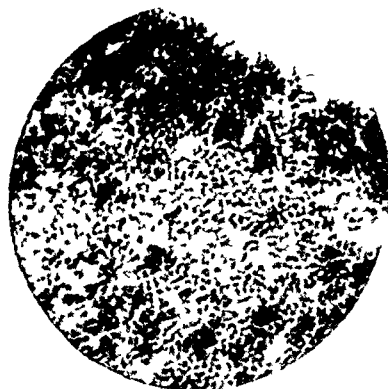

Fig 80 —Same case as Fig 79

Fig 81 —Round celled sarcoma of parotid gland

the tumour recurred 18 months later Dr Porterfield kindly reported that the patient died in 1919 (Figs 79, 80)

A round celled sarcoma occurred in a girl, age 20, and was removed by Mr Jeans in August last (Fig 81)

SUBMAXILLARY TUMOURS

The 13 cases collected did not offer much for investigation , in only one case was the after-history obtained On analysis 8 cases were adenomata, 4 carcinomata (3 spheroidal-celled, 1 cubical celled), 1 sarcoma Sex distribution was equal in the simple cases The average operation age was 35 6 years One tumour had existed 15 years

Figs 82, 83 —Mr R H —Died at the age of 50, 5 months after an operation for carcinoma of the submaxillary gland , the lymphatic glands were involved at time of operation At death secondary deposits were present in the lungs Patient of Dr J C Matthews

FIG 82 —Mixed tumour of submaxillary gland 1o years dur tion Skin scarred by an application of soap and lime

FIG 83 —Spheroidal celled carcinoma of submaxillary gland Same case as Fig 82

SUMMARY AND CONCLUSIONS

1 Of cases operated upon for salivary-gland tumours, 137 have been investigated and the after-histories of 40 obtained, the majority of which are at least 5 years after the operation

2 Of these, 124 cases occured in the parotid and 13 in the submaxillary gland , of the former, the proportion of females to males was 59 19 in simple cases, 12 8 in carcinoma 3 2 in sarcoma, and about equal in those of submaxillary origin

3 Of the 124 parotid tumours, 91 (73 4 per cent) were adenomata (this tumour is also called embryoma, endothelioma, and mixed tumour), 27 (21 8 per cent) were cancer, and 6 (4 8 per cent) were sarcoma Of the cancer cases, 7 out of 20 (35 per cent) arose from degeneration of an adenoma

4 Two varieties of adenomata were recognized, the diffuse and the acinar , and two varieties of carcinoma, the spheroidal-celled and the cubical-celled (adenocarcinoma)

5 Of the adenomata operated upon over 5 years ago, 15 5 per cent have recurred Recurrence was immediate in the majority of cases, or under 12 months It is due to the liberation of healthy cells so frequently seen splitting the capsule in the sections examined Capsule-splitting with the resultant inflammatory reaction explains the sudden increase in size and pain so often described in the history of the patient

7 Excision rather than enucleation would diminish the risk of recurrence due to leaving remnants of capsule , and preliminary ligation of the external carotid artery is advisable in any large adenoma or malignant growth

8 Facial paralysis was not met with prior to operation in the simple cases Post-operative facial paralysis is more frequently due to tension relaxation of the nerve by removal of the tumour than to nerve section, and is therefore usually temporary

9 The contention that operation hastens inoperable recurrence, shortens life, or causes disfigurement has no support in this research , and the fact that 35 per cent of cases of carcinoma arise in simple tumours of long standing should serve as a warning to those willing to allow a pre-operative delay of 7 years in primary cases and 5 5 years in recurrent cases

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VISITS TO SURGICAL CLINICS AT HOME AND ABROAD

PLASTIC SURGERY AT THE QUEEN'S HOSPITAL, SIDCUP

THREE branches of surgery underwent material change during the war the treatment of fractures, the treatment of wounds of the chest, and the treatment of severe injuries of the face Fractures of the femur and wounds of the chest had been of frequent occurrence in civil life but no surgeon had had a large experience of serious facial injuries involving multiple compound fractures of one or both jaws, with hideous destruction of the soft tissues Every surgeon had performed a few rhinoplasties and had endeavoured to relieve the extensive scarring which had followed burns of the face and neck , but for the most part they had left untouched the deformity caused by syphilis or lupus, and had rarely practised the removal of hairy moles or other congenital malformations which are so often a cause of misery to the self-conscious and unhappy sufferers

Plastic surgery, therefore, was in its infancy at the beginning of the war, and even the general principles of treatment had not been formulated All, however, was soon changed when severe injuries of the face began to pour into the general hospitals at home, and it became clear that the surgeon and the dentist must work in the closest harmony if any advance was to be made in their treatment

The experience of ten thousand cases in one hospital alone has now taught what can and what cannot be done by the surgeon working hand in hand with the dentist, and has evolved a special type of surgeon, of dentist, and of anæsthetist—the surgeon infinitely patient

FIG 84 —Major H D Gillies, C B E

and gifted with imagination so that from the very beginning he can foresee the end the dentist fertile in suggestion and a good mechanician , the anæsthetist such an one as can keep a patient motionless for hours at a time, even when much of the face has been destroyed and the cavity of the mouth is fully exposed Major H D Gillies, C B E , proved himself such a surgeon , Captain W Kelsey Fry, M C , undertook the dental problems , Captain R Wade and many others acted as anæsthetists

The work began in January, 1916, at the Cambridge Hospital, Aldershot, when Major Gillies is surgeon and Captain L A B King as chief dental surgeon determined to advance the treatment of gunshot wounds of the face and jaw The accommodation was soon found to be inadequate at the Cambridge Hospital, as the number of patients increased and the results proved to be more and more satisfactory A well-wooded park (Fig 85) was secured between Sidcup and Chislehurst in Kent, about twelve miles from London Special huts (Fig 86) were built in it, with twenty to fifty beds in each The

hospital was placed on an imperial basis under the command of Lieut -Colonel J Colvin, and was one of the hospitals in which the overseas men were treated by their own medical officers   The hospital was quickly filled with a succession of badly-wounded men who could be kept in it for an indefinite period   Major Gillies continued to act as surgeon with the able co-operation of Major Seccombe Hett, who interested himself more especially in the treatment of injuries of the nose, whilst Captain Kelsey Fry and others devoted themselves to wounds of the jaw

The continuity of the records of the patients has been a remarkable feature in the work of the hospital   The very complete system of notes is supplemented by drawings casts, and photographs of the patients in successive stages of the repair of their injuries   The drawings were made by Professor H Tonks Slade Professor of Fine Art at the London University, who devoted many months of his time at Aldershot to producing a series of pastel drawings, and his work was afterwards carried on by Mr Sidney Hornswick   The plaster casts were made by the sculptor, Lieut J Edwards in further illustration of the injuries recorded by the drawings   These casts serve a double purpose, for they not
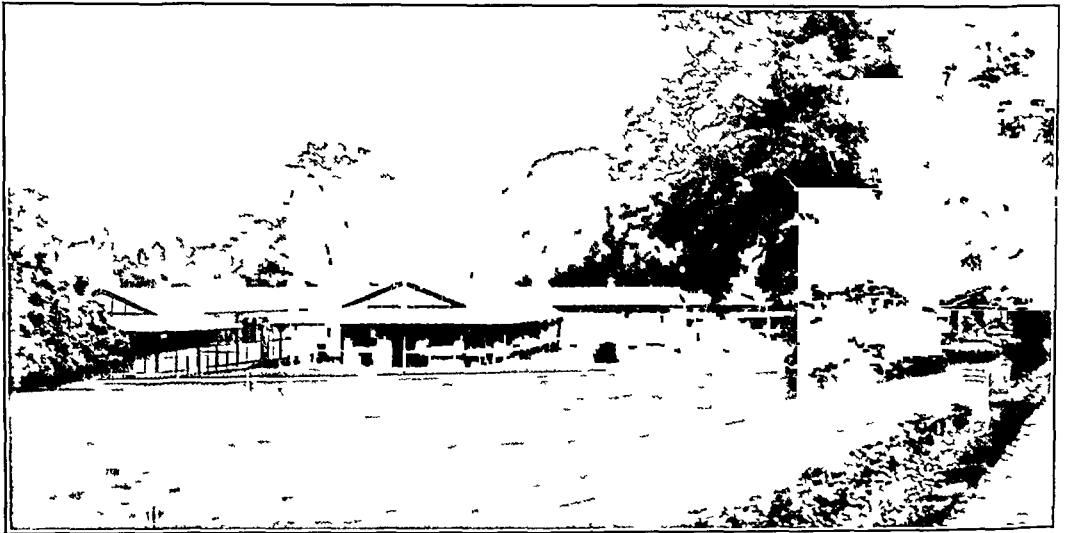
FIG   5)—The Queen's Hospital Sidcup

only show the injuries in various stages of repair but they can be used to reconstruct the features before the actual surgical operation is undertaken   Captain H Mulren Johnston standardized the position for the radiographic records, his work as radiographer being afterwards carried on by Captain R A C Rigby   whilst Mr Sidney Walbridge produced in excellent series of photographs   These records are so valuable and unique that the greatest care should be taken to preserve them when the hospital is closed   It is desirable that they should be put into the hands of some public body—preferably one which has a library as well as a museum   They illustrate the development and progress of the treatment of facial injuries from its infancy to the present time   and it will be a permanent loss to surgery if they are dispersed or are negligently treated

Three operations were being carried out in two operating theatres at the time of my visit   Mr T P Kilner was engaged in grafting 4½ in of the crest of the ilium into a mandible defective to this extent   Mr Gillies was repairing a mandible where there had been a great loss of the soft tissues as well as of the bone   and Captain Shaw was making a new nose   Each patient had already been operated upon at several different hospitals, and each had been sent to Sidcup for final treatment

The anæsthetic was given to the patient operated upon by Mr Gillies and also to Mr Kilner's patient by Shipway's intratracheal apparatus, the anæsthesia being conducted so smoothly by Dr McGill and Dr Rowbotham that the patients remained motionless from 10 a m until 1 p m, and yet when I saw them in the ward at 1 15 both men were well on their way to recovery, and the sister stated that post-anæsthetic vomiting in such cases of prolonged narcosis was rarely severe

The buccal cavity was completely exposed in the patient upon whom Mr Gillies operated, as the centre of the mandible had been blown away and there was a corresponding destruction of the soft tissues of the lower lip, so that the under surface of the tongue was completely exposed   The anæsthetic was given intratracheally through a catheter passed along the nostril, whilst a piece of rubber tubing was passed into the opposite nostril to provide a return airway   Ether was employed under positive pressure and was carried by a stream of air propelled from a small electrically-driven motor

The principles which govern the practice of plastic surgery at Sidcup are   First, complete asepsis   Secondly, the free exposure of parts—and this often necessitates a return
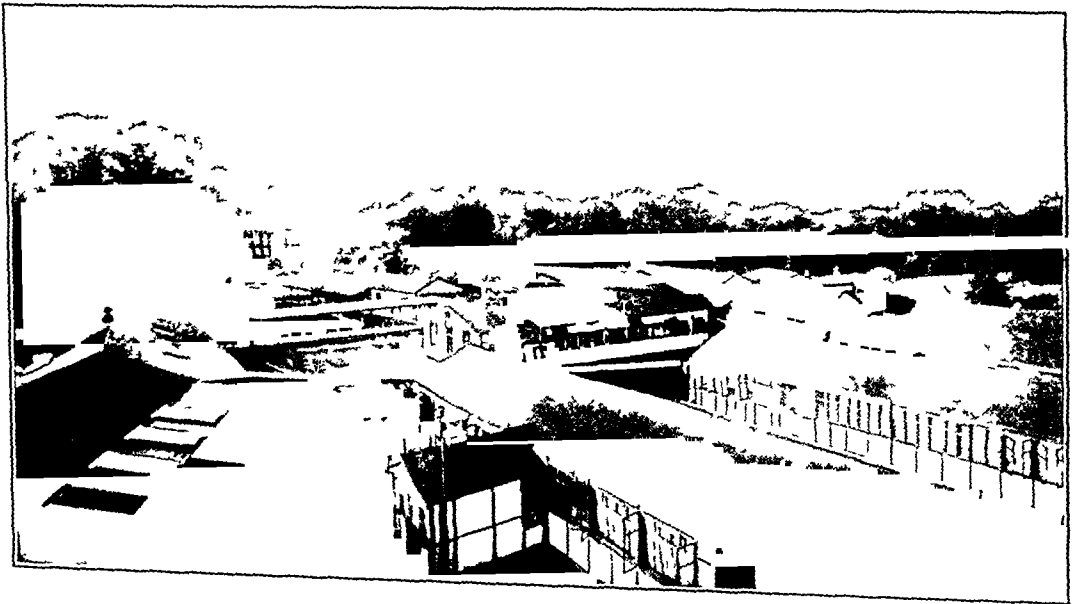
Fig 86 —View of the special huts at the Queen's Hospital Sidcup

to the original deformity, because all the patients now admitted to the hospital have been previously operated upon elsewhere   Thirdly, repeated operations, each operation being designed to attain some definite step towards the final result   No attempt, therefore, is made to do too much at a single sitting   Fourthly, the formation of long and supple flaps free from scar tissue and with a thoroughly good blood-supply   Lastly, the accurate apposition of skin to mucous membrane, or, when this is impossible, the provision of a lining membrane for all mucous cavities, such lining membrane being usually taken from the skin either in the form of flaps or grafts

In the case operated upon by Mr Gillies a flap had been cut from the left side of the chest ten days previously   The flap measured six inches in length and two inches and a half in breadth, and had extended through the entire thickness of the skin and superficial fascia   The free edges of the flap had been brought into apposition, and sutured along their whole length   to form a tube which still remained attached to the general surface of the body at each end   At a second operation the tip of the flap had been detached from the chest and re-attached to the soft tissues on one side of the gap in the mandible It was intended that this flap should form both the lining membrane of a new lower lip

and the covering epithelium of a new alveolar ridge, so that eventually a full sized bone-graft might safely be inserted to reconstruct the lost portion of the mandible During the short period which had elapsed since the dissection of the flap, the edges had united by first intention, and the flap presented itself as a roll of tissue of the size and consistency of a flaccid penis, attached at one end to the margin of the buccal wound, and at the other to the skin of the neck, from which it had not yet been separated It was lying free in the interval between these two points, and the skin beneath it had healed   The flap was of the same temperature as the surrounding parts, and was evidently well supplied with blood

The object of the morning's operation was to secure a further attachment of the graft along the floor of the mouth to form a new lining membrane for the lower lip and alveolus which would be made by a subsequent operation   For this purpose the tubular graft was laid open by an incision carried along the whole extent of its free portion, and its edges were sutured to the refreshed surface of the tissues on the under surface of the tongue, care being taken to secure complete hæmostasis   The skin of the neck, including the platysma, was released by incisions carried beneath the upper end of the pedicle to allow the flap to slide forwards and thus relieve any undue tension upon it   These proceedings were sufficient for the time and nothing more was attempted

Mr Kilner was engaged in bridging a 4½-in gap in the mandible of another patient, whose lower lip was intact   The bed having been prepared for the graft, and the ends of the fractured bone having been refreshed and pierced for the passage of a silver wire, the graft was taken from the crest of the ilium It was cut with a mallet and chisel, and included the periosteum, the outer compact tissue, and a layer of cancellous tissue , but the inner table of the bone was not taken   The graft, which had been carefully measured to fit the gap in the mandible, was bevelled at each end, and was partially divided transversely at several points to enable it to retain a curved shape   It was then laid aside in a warm and dry sterilized towel until it was required   When all was ready for its recep tion it was transferred to the gap , its ends were perforated with two holes corresponding to those which had been made in the ends of the fractured mandible, and it was wired in place with two silver wires the periosteal surface being placed externally   The soft tissues were then brought together lightly over the graft

Mr Chubb and Mr Russell, the other two surgeons attached to the hospital, were not seen at work, but it was understood that the principles which guided them were essentially the same as those described above

Where all have done well it is difficult to single out one for special praise, but Mr H D Gillies has had the longest and most continuous experience whilst his large and well-illustrated work on *Facial Deformities* shows how seriously he has undertaken the subject and how much he has done to advance it   A New Zealander by birth and educa-tion, he has proved himself as good an athlete as he is a surgeon   Born at Dunedin in 1882, the son of Robert Gillies, a member of the House of Representatives, he was capt un of the Cricket XI at Wanganui College, where he received his early education   Coming to England, he rowed in the Cambridge University boat in 1904, and played golf for Cambridge in 1903, 1904, and 1905   He played golf for England v Scotland in 1908, and won the St George s Grand Challenge Cup in 1903   He received his medical education at St Bartholomew s Hospital, where he played as first violin in the Hospital Musical Society , he also sketches in water-colours   It can be no matter of surprise, therefore, that one who has so complete a power of muscular co ordination should prove himself an adept in the minute work of plastic surgery

The photographs illustrating this article were taken by Mr S Walbridge the official photographer to the Queen s Hospital, Sidcup

THE PROGNOSIS OF CARCINOMA MAMMÆ
A REVIEW OF 169 CASES

By G PERCIVAL MILLS Birmingham

The cases under review were those operated on in the General Hospital, Birmingham, during the years 1910-15, to which have been added, through the kindness of Sir Gilbert Barling, a number of cases from his private practice   The investigation was primarily intended to be pathological, and for this reason those cases alone are included in which I have personally studied microscopical sections of the tumour   I was able to do so in practically all the hospital cases, and in the great majority of the private ones, so they may be considered as fairly representing the period in question   The clinical notes in most of the hospital cases were made by myself specially for the purpose, and in the private cases were made by Sir Gilbert Barling   I was fortunate in having the assistance of Professor Shaw Dunn in making the pathological notes on some of the more difficult cases, and to him I owe my grateful thanks

The usual difficulty was experienced in selecting any period for a standard of cure, for recurrences may of course take place after almost any interval   They are not common after six years, however, and as all deaths during the six-year period from whatever cause are included as due to carcinoma, the deaths from other causes during this period will about balance the few probable recurrences later   A six-year period has therefore been taken as the standard of cure, and it has the advantage of being about the period since the last of the cases under review was operated on

The cases were all pathologically carcinoma, and in all but eleven of them a clinical diagnosis of carcinoma was also made before operation   Of the total 169 cases, 129 were in hospital and 40 in private

In all, only 118 cases were traced up to six years after operation   A system of routine inquiries every six months was interrupted by the war, and many cases were therefore lost sight of from one to three years after operation   A belated inquiry after the war was over usually resulted in the post-office formula, " gone, no address ", and these cases were excluded from the statistics   When, however, an envelope was returned marked 'deceased , the case was included and the death presumed to be due to carcinoma

Of the 118 cases traced, 47, or 39 8 per cent, were living and well at the end of six years , of 87 hospital cases, 32, or 35 5 per cent, were well , of 31 private cases, 15, or 48 4 per cent, were well   This difference is not due entirely to the private cases having been operated on earlier, as is shown by the figures for cases in which the glands were already infected (vide infra)

Involvement of Glands —The next step was to separate the cases into those in which the glands were infected microscopically and those in which they were free, and a word of explanation is necessary before these figures are presented   Certain very striking changes have been described in the lymphatic glands which drain a cancerous area, and are considered by some to be a definite pre-cancerous condition, while regarded by others as a mere chronic inflammation or hyperplasia   While I personally believe that this condition is due to a cancerous invasion in the sense that it is a reaction of endothelial cells to infection, I have not included such cases among those in which the glands were infected   Under the heading 'gland infected' are included only those cases in which a definite epithelial growth was found in the glands   Doubtful cases have been classed as negative

GLAND-INFECTED CASES —

Of 71 gland-infected cases, 13 or 18 3 per cent were well in six years
, 56 hospital cases,   7, or 12 5   ,,   ,
15 private cases,   6, or 40   ,   ,

This very striking difference between hospital and private cases is probably due in part to the more frequent use of prophylactic irradiation in the latter   Of the cases which died under six years, the average duration of life was in hospital cases twenty months, in private twenty-five months   Here the difference is easily explained by the better social condition of the patients and the more frequent use of irradiation

FIG 5   Tumour classified as   carcinoma simplex plus duct changes   Note overgrowth of duct epithelium
Most of the section showed a typical scirrhus

GLAND-NEGATIVE CASES —

Of 54 cases, 34, or 62 9 per cent, were well in six years   This must be regarded as a very satisfactory figure   For hospital cases the figure was 65 8 per cent, and for private cases 56 2 per cent

The average duration of life in cases not living six years was in hospital cases twenty-eight months and in private cases thirty-three months   The relatively small number of private cases prevents much being made of a small difference in percentage, but the increased longevity of fatal cases in private is again notable

Pathological Classification —Primarily it was intended that this inquiry should be almost entirely pathological I had been so impressed with the very variable behaviour is regards the recurrence of tumours clinically similar in character and extent, that I hoped a careful microscopical study would reveal differences on which a logical prognosis

might be based   It soon became evident, however, that most of the distinctions I had hoped to make, such as degree of fibrosis', 'size and arrangement of cells', leucocyte infiltration', etc , concerned characters which varied infinitely in different parts of one and the same tumour   Consequently it was only possible to distinguish here and there some exceptional character in certain tumours, and to work out the prognosis separately for these cases, to see if it were better or worse than the average   The occurrence of squamous metaplasia for example, was studied in this way, but found not to affect the prognosis

Fig 8   Squamoid tumour   Note the was ive alveoli of polymorphic cells fitting closely to the stroma and the central degeneration in each alveolus   In this case the peripheral cells tend to be columnar

Finally, the tumours were grouped into four classes as follows —

1 *Typical carcinoma simplex*, or spheroidal celled carcinoma, whatever the degree of fibrosis and whether columnar or squamous metaplasia was present or not   Of this type there were 88 cases

2 *Carcinoma simplex plus duct changes*   A similar tumour to *Class 1*   it contained in addition numerous dilated ducts showing definite and frequent epithelial overgrowth Of this there were 14 cases (Fig 87)

3 *Papillary carcinoma* showing definite local infiltration   Of this there were 4 cases

4 A peculiar tumour which, on the suggestion of Professor Shaw Dunn, I have called a squamoid   It consists of very large alveoli of polygonal cells with large nuclei , the cells at the periphery of the alveoli are flattened and fit closely to the stroma, giving the tumour the appearance of a squamous carcinoma   There are, however, no prickles and no cell nests   A characteristic feature of the tumour is the regularity with which degener-

ation occurs in the centre of each large alveolus, resulting in large rings of tumour-cells
In older parts of the tumour these rings coalesce and give rise to curious serpigenous
bands of tumour-cells   Clinically these tumours are hard, slow-growing, and usually
firmly attached to the skin (*Figs* 88 and 89)   Of this tumour there were 10 cases

Of the 88 cases of *Class* 1 (carcinoma simplex), 29, or 32 9 per cent, were well
in six years , i e , about 6 per cent less than the average for all cases

Of the 14 cases of *Class* 2 (carcinoma simplex plus duct changes) 8, or 57 1
per cent, were well in six years

Of the 4 cases in *Class* 3 (papillary carcinoma), all were well in six years

Of the 10 cases in *Class* 4 (squamoid), 4, or 40 per cent, were well in six years
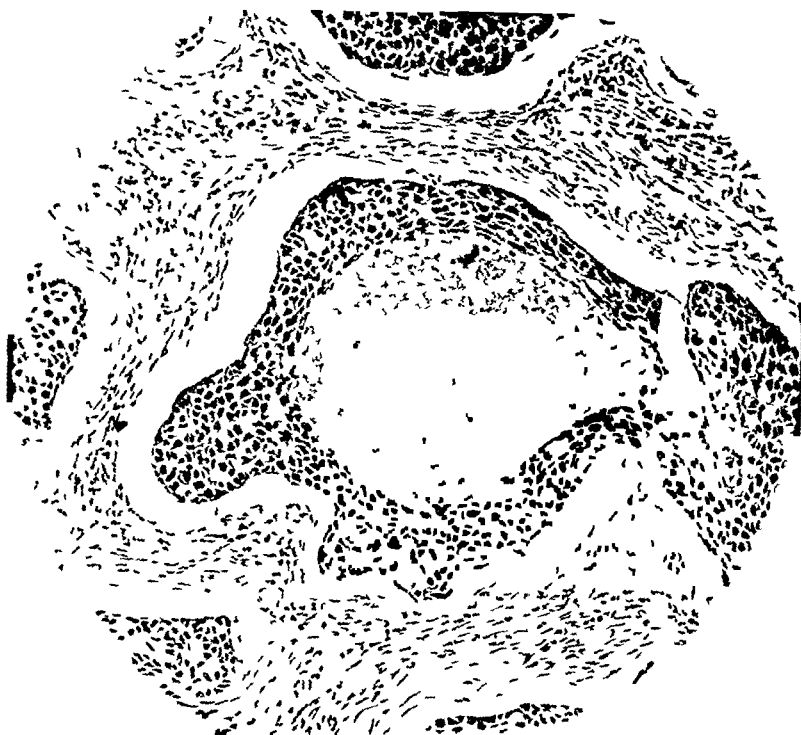
Fi 89 —Another example of a squamoid   The tumour cells have shrunk away from the stroma,
and the peripheral cells are definitely flatt nc l

The prognosis is therefore worst for typical carcinoma (32 9 per cent), better for a
squamoid (40 per cent), better still for a carcinoma with duct changes (57 1 per cent), and
very good for papillary carcinoma   At first sight it would appear that to distinguish
cases with this epithelial overgrowth of ducts as a separate class is entirely artificial, and
it is certainly very doubtful if they are pathologically a different type of tumour   In
examining large numbers of sections, however, it was noticed that this overgrowth of duct
epithelium was present in a certain small proportion and the figures for these cases were
worked out separately, with the results stated above   It should be made clear, perhaps
that these were not clinically cases of 'duct carcinoma , they were clinically carcinoma of
the common type, and it was only on microscopical examination that the duct changes

were noted   An explanation suggested by the recent work of Sir Lenthal Cheatle is that the majority of breast carcinomata start as an overgrowth of duct epithelium, and that as the tumour grows by infiltrating the periductal tissues, the original ducts are crushed out of all recognition   Consequently, in only a comparatively early case are these pathological ducts visible, and in an early case the prognosis is, of course, better   In other words, the presence of these ducts in a section does not indicate any special type of tumour, but merely that we are dealing with an early case   Whatever be the explanation, the figures appear to show that when these ducts are present the prognosis is about 24 per cent better than in their absence

Nor is it possible to regard the 'squamoid' as a definite pathological entity   for though its typical appearance is utterly different from that of an ordinary carcinoma, there have been cases (two) in which a section from one part of a tumour has been a squamoid and from another a carcinoma simplex   Moreover, there are intermediate cases, and in some—where the primary growth has been difficult to classify—the secondary growths have been squamoids   In a typical squamoid, however, there is nowhere the appearance of carcinoma simplex, and only such cases are included under this heading

Clinical Enlargement of Glands —The importance of the pathological involvement of glands raises the question of the prognostic value of their clinical enlargement   In the first place it is necessary to determine in what proportion of cases with clinical enlargement of glands pathological infection has already taken place   Of 50 cases with clinical enlargement of axillary glands, 30 were infected and 20 were free   This represents an error of 40 per cent, which renders clinical enlargement of axillary glands a sign of uncertain prognostic value   Conversely, of 23 cases in which no glands could be felt, 11 were infected and 12 free   One is accustomed to attach great importance to the hardness of enlarged axillary glands in carcinoma, but in this series out of 25 cases with hard axillary glands, there were 9 not infected   Clearly, therefore we can expect only a rough accuracy in estimating the prognosis according to this factor   The actual figures are —

Glands clinically absent, 19 cases , 9, or 46 2 per cent, were well in six years
Glands clinically enlarged, 50 cases   16, or 32 per cent, were well in six years   Glands enlarged and hard, 25 cases   6, or 24 per cent, were well in six years

Age of Patient at Operation —This factor has proved of less importance than was expected, probably because any death within six years of operation was regarded as due to carcinoma   If age has any effect in improving the prognosis, it is evidently counterbalanced by the greater natural death-rate for the later periods of life

Of cases with non-infected glands who were well in six years, the average age at operation was 49½ years

Of cases with non-infected glands who died under six years, the average age at operation was 48½ years

Of cases with infected glands who were well in six years, the average age at operation was 50 years

Of cases with infected glands who died under six years, the average age at operation was 48½ years

The differences, of course, are negligible, and it would appear that the importance of age has been exaggerated

Duration of Growth before Operation —Average duration of growth in 32 cases well in six years was 9 months   Average duration of growth in 55 cases dead under six years was 9 months   The figures give no help to prognosis   Obviously there are two factors in the case which neutralize each other   The slow-growing, relatively benign tumour is left a long time before complaint is made, whereas the rapidly-growing very malignant tumour attracts attention early

Adhesion to Skin —Of 76 cases of tumour adherent to the skin, there were alive and well in six years, 29 or 38 1 per cent

Of 29 cases of tumour not adherent to the skin, there were alive and well in six years 12, or 41 3 per cent

The figure for adherent cases is only a trifle below the average for all cases (39 8 per cent), while that for non-adherent cases is about the same amount above it   Adhesion to skin therefore makes little difference to prognosis   There are again probably two factors at work here, for though adhesion to skin is, *per se*, a bad sign, its early occurrence may indicate that the growth was in a superficial part of the breast, and that adhesion to muscle, a much more serious sign, would occur late

Adhesion to Muscle—Of 32 cases of tumour adherent clinically to the pectoral muscle, there were alive and well in six years 7   or 21 8 per cent

Of 66 cases of tumour not clinically adherent to the pectoral muscle, there were alive and well in six years 34, or 51 5 per cent   As one would expect the prognostic importance of adhesion to the muscles is clearly brought out

Obesity—It is a common belief that the prognosis in obese patients is much worse than the average and that it is best in rather spare people   Unfortunately, it was only rather late in the inquiry that I began investigating this point, and consequently the figures are rather meagre   They are, however, very suggestive

In 18 cases I have described the patient as 'obese' or 'rather obese', in 9 as 'normal', and in 5 as spare'

Of the 18 obese patients, 2, or 11 1 per cent, are well in six years
Of the 9 normal patients, 6, or 66 6 per cent, are well in six years
Of the 5 spare patients, 1, or 20 per cent, is well in six years

The figures, though very small, show clearly that obesity is a bad sign, and suggest that spare people do not do so well as the normally fat

General Clinical Considerations—It remains to be seen, after considering these individual factors, how far general clinical considerations can guide us in making a prognosis   For this purpose the cases were divided into two classes, according to the favourable or unfavourable clinical condition before operation   Cases with a small growth, not adherent to muscle and with slight or no enlargement of axillary glands were classed as favourable   as were also cases which were clinically duct carcinoma   A few were omitted owing to imperfect notes   Of 30 favourable cases, 19, or 63 3 per cent, were alive in six years   Of 51 unfavourable cases, 9, or 17 6 per cent, were alive in six years   It is clear, therefore, that clinical considerations are a valuable guide to prognosis before operation, but that a final prognosis can only be made after microscopical examination of the glands

Nature of Operation Performed—For statistical purposes the various operations must be classified into a few main types, and, in fact they fall naturally into three classes

1 *Sampson Handley's operation*

2 *Halstead's operation*, under which heading are included all cases in which the underlying muscles were removed but in which no effort was made to remove a very extensive area of deep fascia

3 *An admittedly imperfect operation*, performed in certain cases on account of the bad condition of the patient, and occasionally for other reasons

The gland-infected and gland-free cases are considered separately on account of their very different results

CASES WITH GLANDS NOT INFECTED —

1 *Sampson Handley's operation*
16 cases   11 or 68 7 per cent, were well in six years
2 *Halstead's operation*
23 cases,   14 or 60 8 per cent, were well in six years
3 *Imperfect operation*
14 cases   9, or 64 3 per cent, were well in six years

The figures for the first two classes are much as one would expect, but those for the third are really startling, and certainly demand a closer analysis of the cases   On looking

through the cards of these cases one is at once struck by the fact that there was something distinctly unusual in the clinical signs or pathological findings in nearly every one To make this clear it is necessary to consider them briefly in detail

CASES OF RECOVERY AFTER INCOMPLETE OPERATION

Case 1 — M A A, age 36 One years history of lump in right breast In upper and outer quadrant of right mamma was a hard lump the size of a Brazil nut feeling like a mass of chronic mastitis A small, hard mass low down in axilla Breast and one gland only removed The lump consisted to the naked eye of a typical patch of chronic mastitis within which was a brownish lump of a uniform hard consistence Microscopically it was a papillary carcinoma Patient is well ten years later

Case 2 — F D, age 42 Eleven months history of a sore nipple with discharge Induration round nipple, with nodules on the nipple itself No glands Breast and axillary glands were removed Pathologically a papillary carcinoma Patient well six and a half years later

Case 3 — T D, age 56 Lump in the left breast for twenty years for six months it had been growing rapidly A very obese woman with large breasts In the upper and outer quadrant of left mamma was a stony hard knobby lump the size of a foetal head Just becoming fixed to skin, free from muscles Partially fixed in breast but more movable than a carcinoma Breast pectoral fascia, and axillary glands removed Microscopically the major part of the growth was a cystic fibro adenoma but in one part the matrix appeared to be sarcomatous Professor Shaw Dunn pointed out to me, however that in another part there was a definite carcinoma Patient was well in eight years

Case 4 — M M, age 74 A senile carcinoma Breast pectoral fascia and axillary glands removed Pathologically, carcinoma simplex Patient died of senility eight years later

Cases 5, 6, and 7 — These were clinically and microscopically early scirrhus Breast pectoral fascia, and axillary glands were removed They are well twelve seven and six years later respectively

Case 8 — C R, age 43 Lump in left breast for four months The rather imperfect notes say there was "a nodular carcinoma the size of an orange in the left breast Breast pectoral fascia and axillary glands were removed Microscopically a squamoid Patient was well seven and a half years later

Case 9 — E H, age 45 A painless lump in right breast for six months Rather obese woman In the upper and outer quadrant of right mamma was a rather soft rounded tumour the size of a golf ball Very firmly fixed in breast Just adherent to the skin and to the outer part of pectoral muscle No glands in axilla No evidence of chronic mastitis A needle withdrew clear fluid, but lump did not disappear The surgeon in charge regarded it as simple and removed it locally—I frankly admit to my own intense disgust Microscopically the tumour was a carcinoma showing squamous metaplasia and very marked early degeneration of the tumour cells In view of the after history of the case I showed this section to Professor Shaw Dunn who described it is a very malignant carcinoma Patient is alive and well nine years later

On reviewing these cases in detail, one sees that the good results obtained are misleading, because evidently the incomplete operations were frequently done on account of the very early or doubtful malignancy of the case Two were duct carcinomata one a cystadenoma just become malignant, one a senile carcinoma and three very early carcinomata Only in the last two is the result very surprising and Case 9 must obviously be looked on as altogether abnormal Admitting, therefore, that the results do not justify incomplete operations as a routine they do show that in early cases when for any reason a complete operation is unsafe, an incomplete one may be undertaken with a fair prospect of cure

CASES WITH GLANDS INFECTED —

  1 *Sampson Handley's operation*

    21 cases , 4, or 19 per cent, were well in six years

  2 *Halstead's operation*

    33 cases , 6, or 18 2 per cent, were well in six years

  3 *Imperfect operation*

    5 cases , 1, or 20 per cent, was well in six years

These figures do not show a great superiority in the results of removing a wide area or deep fascia Those for the imperfect operations are too small to be of value Yet

the kidney was normal to the naked eye   The specimen, which weighed 1½ lb   was placed intact in Kaiserling solution   As the condition of the patient caused some anxiety, the removal of the calculus was postponed   Healing took place by first intention

On June 1 the calculus was removed by suprapubic cystotomy, and the bladder was immediately closed   The abdominal wound was sutured in layers, leaving a small aperture for the insertion of a drainage tube into the space of Retzius

Description of Specimen (*Fig* 90) —The following is a short description of the specimen after hardening in Kaiserling   The upper pole of the kidney is replaced by a large globular sac, 10 cm by 9 cm   This, on section, is seen to consist of a number of cysts, for the most part completely separated from one another   Two of the cysts are of large size and form the main part of the tumour   The cysts vary in size from that of a hemp-seed to that of a small orange   The wall of the main sac is thin and translucent in parts   Elsewhere it is thicker, and partly composed of flattened cysts   The medium sized cysts are somewhat angular in shape, and their walls are thin and delicate   The pelvis of the kidney at its upper half seems to form part of one of the cysts and to be lined by a similar membrane   This part of the pelvis is dilated, and the uppermost calyx is distended   A solid bud projects into one of the upper calices   The large cysts contain clear fluid of a greenish tinge , in some of the cysts the contents are jelly-like and quite green in colour , in others blood-clot is seen   Professor Symmers made a microscopical examination of the specimen, and reports as follows   ' Main part of kidney, normal   In the immediate neighbourhood of the fibrous wall of cyst the contiguous portion of kidney showed Malpighian capsules small and atrophied , renal tubules, scarcely recognizable as such, being compressed laterally and scarcely showing any
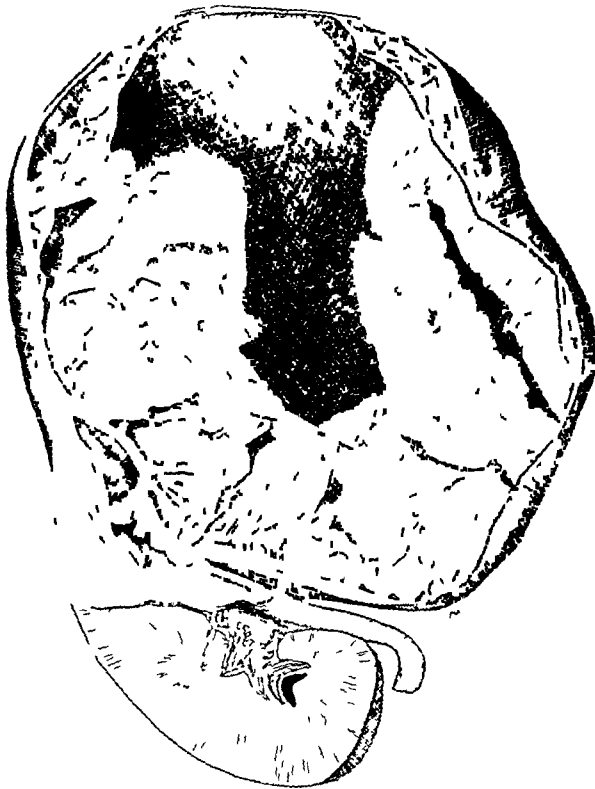
Fig 90 —Polycystic disease of kidney

lumen   The epithelial cells lining the tubules are small and granular   The outer wall of cyst is composed of compact fibrous tissue with a somewhat fenestrated appearance, owing to numerous small clefts between the bundles of fibrous tissue   Abutting on the lumen of cyst the fibrous tissue is much more loose less dense, and lined by some indistinct flattened cells   The septa are thinner, but show a similar arrangement "

Contents of Cyst —Owing to the presence of formalin in the Kaiserling fluid it was found impossible to obtain a satisfactory examination of the contents of the cyst   Dr John Milroy, of the Physiological Department of Queen s University, and Mr Harold Totton, analytical chemist did what was possible, but were dissatisfied with their results

Dr Milroy reports that the contents of the cyst are greenish in colour, but show no absorption bands   The pigment remains in the aqueous layer after the fluid has been extracted with amyl alcohol both in neutral solution and after acidification with dilute

acetic acid   The contents of the cyst are partly gelatinous in character and their consistence suggests the presence of mucin   On heating, only a small amount of coagulable protein separates out   This result may, however, be due largely to the action of the formaldehyde used for fixation   On acidifying the solution with acetic acid a dense precipitate of protein was thrown down   This was filtered off, washed repeatedly with alcohol to remove the formaldehyde, and then boiled for four hours with normal hydrochloric acid   The resulting solution after neutralization reduced Trommer and Fehling's solutions only slightly   The latter result indicates that only small quantities of glycoproteins or true mucins are present   Part of the protein was precipitated with acetic acid, filtered off, washed with hot dilute acetic acid and then repeatedly with hot alcohol to remove inorganic phosphates and phospholipins   The residue after incineration with sulphuric and nitric acids (Neumann's method), gave a precipitate of ammonium phosphomolybdate   Part of the precipitate, therefore, consists of a phospho- or nucleoprotein

Mr Harold Totton reports that the sample supplied to him is partly liquid and partly jellified   The jelly consists of protein matter rendered insoluble by the action of the formalin   He extracted some of it with hydrochloric acid to see if any oxalates or phosphates were present, but could find none   The separated liquid portion of the sample still contained protein matter, evidently protein not acted on by the formalin   The liquid contained no oxalates or phosphates   The formalin present would interact with urea, if originally present, and a trace of uric acid in such a mixture would be very difficult to detect

Composition of the Stone —Dr Milroy examined the stone, and reports as follows   " The following constituents are only present in traces   calcium, magnesium, oxalic and phosphoric acids   Xanthine and cystine are absent   The stone leaves little ash on incineration, and consists almost entirely of uric acid   In the centre of the stone there is a small amount of fibrous material, probably of a protein nature '

Classification of Cysts of the Kidney —Henry Morris[1] classifies cysts of the kidney as follows —

1 The small and numerous cysts which occur in granular kidneys, and which are of pathological rather than clinical importance
2 Dermoid cysts
3 Simple cysts
4 Conglomerate cysts, polycystic disease, or cystic metamorphosis of the kidney
5 Hydatid cysts
6 Paranephric cysts, or cysts which are external to the capsule and formed in the circumrenal fatty tissue, but which are intimately adherent to the kidney and sometimes communicate with the renal cavity

The specimen here described would appear to come under the fourth heading   Conglomerate cysts, polycystic disease, and cystic metamorphosis of the kidney are names which indicate a condition which is now generally described as congenital cystic kidney   This disease is almost always bilateral   Morris[1] quotes several authors in support of this   Dickinson found only one case out of 26 in which the disease was confined to one kidney   Lejars, out of 62 cases in the adult, found only one case which was unilateral, and in that case there was a round cystic space the size of a penny piece in the cortical substance of the other kidney   Ritchie states that in post-mortem examination of 88 cases both kidneys were found polycystic in all but two   In this disease the whole kidney is generally affected, and a large number of cysts replace medullary and cortical portions alike, and project on the surface of the organ   Bland Sutton,[2] however, says that there is reason to believe that the cystic change may be limited to a part of the kidney, and quotes in support of this a case described by Edmunds[3]   This case will be referred to later

A photograph and description of my specimen were sent to Professor Shattock at the Royal College of Surgeons in London, and he informs me that " the only localized polycystic tumour of the human kidney of which the specimen is mounted and preserved is one in St Thomas's Medical School Museum   This is figured and shortly described

by Mr Walter Edmunds in the *Transactions of the Pathological Society of London,* vol xlii "

Edmunds' specimen was removed during life from a girl, age 18   Projecting from the anterior surface of the kidney there was a globular tumour about 2¼ in in diameter The tumour was enclosed in a separate capsule, and was found to consist entirely of cysts of various sizes, the largest being about 1 in in diameter   The cysts contained a thin colourless fluid, and on microscopical examination were found to be lined with an epithelium, in some places columnar, in some cubical   Kretschmer,[4] in a recent paper dealing with solitary and multiple cysts, gives an account of a case investigated by him This case and the cases in the literature reviewed by him would come under the heading of simple cysts in Morris's[1] classification, and not under that of conglomerate cysts

It is therefore evident that the case under review represents a type of cystic kidney of great rarity   I have had the advice of several pathologists as to the classification of the specimen, and the balance of opinion appears to be that the case is one of localized unilateral congenital cystic kidney

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CONGENITAL OCCLUSION OF THE ILEUM.

By JOHN MORLEY, Manchester

THE problems in antenatal pathology connected with congenital malformations of the small intestine are so varied, and at present so obscure, that it is not desirable that any cases which might throw light on the subject, or even add to the data available, should go unrecorded, and the recent occurrence in my own practice of two cases of congenital occlusion of the lower ileum leads me to submit the following description of them

Case 1 —Congenital Occlusion of the Ileocæcal Valve

A female infant, 2½ days old, was admitted to St Mary's Hospital under my care, Nov 5, 1919, with a history that it had passed no meconium per rectum since birth and that on the morning of admission it had begun to vomit meconium The baby had been taken to a general practitioner for the first time on the morning of admission He gave a simple enema without result, and then sent the child to hospital

FAMILY HISTORY —There had been three other children in the family Of these the first two were boys, and were normal and in good health The third child was a girl, and had died on the fourth day after birth with symptoms exactly resembling those in the present case No post mortem examination had been made

On Admission —The infant weighed 6½ lb It was fairly well nourished, but the eyes were sunken and the fontanelle depressed The abdomen was greatly distended, and coils of small intestine, much dilated, were visible through the abdominal wall in active peristalsis The child was vomiting dark green material at frequent intervals The anus and external genitalia were normal on inspection On digital examination the finger passed through the anal canal into a patent but very small rectum Before my arrival the house surgeon had passed up the rectum a series of uterine bougies, but no meconium had come away

OPERATION —The same evening, after a preliminary subcutaneous saline infusion, the abdomen was opened through the left rectus muscle Coils of greatly distended and hypertrophied ileum presented The greatest distention of the ileum with soft meconium was about 18 inches above the ileocæcal valve In its lower 18 inches the ileum was firmly contracted on to a mass of inspissated contents of the consistency of wet putty The ileocæcal valve lay rather high up in the right abdomen, and the cæcum and the whole of the colon were quite empty and contracted down to a remarkably small calibre The saccules of the colon were perfectly developed, and the appendix had not the infantile apical position on the cæcum The peritoneum contained a little blood, which

FIG 91 —Abdominal viscera removed post mortem from *Case 1* Most of the small intestine has been removed I, Lower ileum S, Stomach C Descending colon L, Liver

came from a tear in the wall of the upper rectum produced by the attempt to dilate it with uterine bougies On account of this injury to the rectum it was decided not to make an enterostomy on the anterior abdominal wall, but to draw the divided ileum down through the anal canal, in the hope of preserving sphincteric control should recovery ensue Accordingly, the most distended coil of ileum was crushed, ligated, and divided The distal end was invaginated by a purse string suture, and the proximal end first emptied into a bowl and then temporarily ligated Curved dressing forceps were next passed up through the anal canal into the peritoneal cavity, dilating the rent already made in the upper rectum, and the proximal end of the divided

ileum was brought down outside the anus, and sutured into position with catgut   The abdomen was then closed   The child stood this rather severe procedure badly, and died some six hours later

POST-MORTEM EXAMINATION   (*Fig* 91) —The whole colon was perfectly formed and fully rotated, but entirely empty of contents other than a little colourless solid mucus, and its average external diameter was only 6 mm   The peritoneal relations of the colon were normal, i e , there was no persistence of ascending or descending mesocolon   The caecum had not fully descended to the right iliac fossa   The rectum had been almost torn across it its junction with the pelvic colon, where the ileum had been drawn down to the anus

On opening the ileum just above the ileocaecal valve and clearing out the thick inspissated meconium, a probe could not be passed into the caecum   The caecum was then opened and a minute quantity of solid whitish mucus found in its lumen   The lumen of the ascending colon readily admitted a probe   Inspection of the ileocaecal valve from the interior of the caecum showed that a complete septum of mucous membrane occluded the valve, and a probe could not be passed through it   No Meckel's diverticulum or other congenital abnormality was present

Microscopic al sections through the centre of the ileocaecal valve (*Fig* 92) showed a normal ileocaecal sphincter, with a complete diaphragm consisting of two
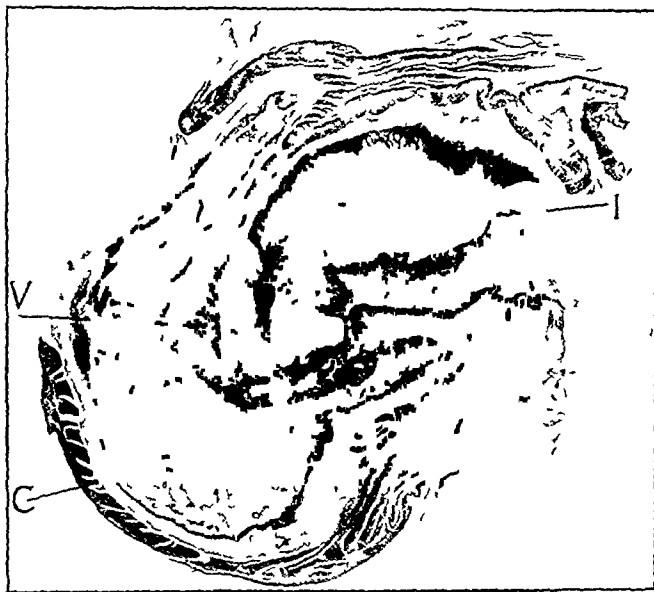
FIG 92 —Low magnification microphotograph of section through centre of occluded ileocaecal valve in *Case* 1   I Lumen of ileum   C, Lumen of caecum   V Upper segment of ileocaecal valve

layers of mucosa and some intervening areolar tissue   There was no evidence of fibrosis such as would suggest intra uterine ulceration

Case 2 —Congenital Occlusion due to Volvulus of the Ileum

A female infant, 8 days old, was admitted to St Mary's Hospital, June 12, 1920   The history given was to the effect that the child had passed what was considered to be meconium from the second day after birth, though it was very small in amount and of a light colour   On the third day vomiting began and was projectile in type   For the last three days before admission it had vomited dark green feculent material in considerable quantity   The family history revealed nothing of importance

ON ADMISSION —The infant was small, emaciated, and jaundiced, with a swollen abdomen It passed a little mucus, faintly tinged with bile, per rectum   The abdomen showed well marked visible peristalsis of the small intestine type   The finger entered the rectum readily, but the rectum above the anal canal was smaller than normal   A diagnosis of congenital obstruction of the lower ileum was made, and operation undertaken as a forlorn hope

OPERATION —After subcutaneous saline infusion the abdomen was opened by an incision through the right rectus muscle   Greatly distended and hypertrophied coils of ileum full of fluid meconium were exposed   On tracing the distended bowel downwards it came to a sudden rounded end three inches above the ileocaecal valve, and appeared to be connected with the ileocaecal junction by a rounded fibrous cord   The caecum was normally placed in the right iliac fossa and fully rotated, but, with the whole colon, was pale and contracted to a very small size, and empty   The sacculation of the caecum was normal and the appendix lay curled up below, and to the inner side of, the caecum   Its base was eccentrically placed, and not situated at the apex of the caecum as in earlier intra-uterine life   Both ascending and descending mesocolon had disappeared   The great omentum extended over the front of the ascending colon, and an extension from its right margin formed a typical Jackson s pericolic membrane

A Paul s tube was tied into the dilated blind end of the ileum, and the wound closed with the end of the ileum protruding through its lower part   Meconium drained away freely after the operation, but the child collapsed and died twenty hours later

POST MORTEM EXAMINATION   (*Figs* 93 and 94) —The hypertrophied ileum was less conspicuous than at operation owing to the evacuation of its contents, but still formed a remarkable

contrast with the white attenuated colon, which had an external diameter of about 5 mm Peritoneal fixation of the colon was normal, but there was a well marked Jackson's pericolic membrane derived from the right free margin of the great omentum There was also a pronounced

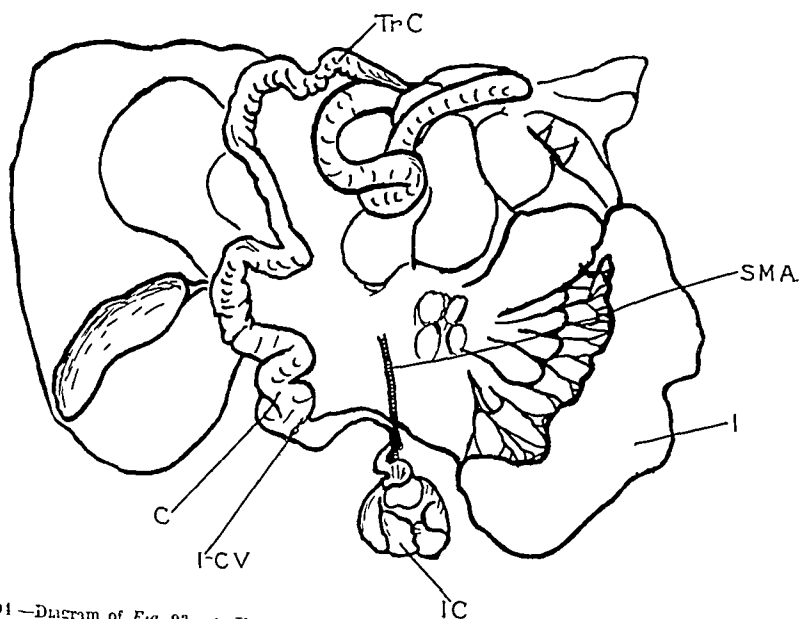Fig 93 —Abdominal viscera removed post mortem from Case 2   For explanatory diagram see Fig 94

Fig 94 —Diagram of Fig 93   I Ileum   SMA, Superior mesenteric artery   IC Isolated coils of ileum
ICV Ileocæcal valve   C Cæcum   Tr C Transverse colon

ileal band (or genitomesenteric fold of Douglas Reid), which ran from the inferior aspect of the mesentery below the blind end of the ileum to the right ovary   Between the blind end of the ileum above, and the ileocæcal valve below, some tiny convoluted coils of bowel little more than

half the diameter of the colon, blind at each end, and containing inspissated mucus tinged with bile, could be made out   These coils were made more obvious by passing a fine cannula through into the lumen and inflating them with air, which demonstrated that they formed a single tortuous portion of the intestinal tube, detached from the bowel above and below   On dissecting these coils free from the great omentum, which was adherent over the front of them and bound them together, they were found to be continuous by a slender fibrous cord with the blind end of the dilated ileum above   They were connected by a similar cord below with an attenuated and conical portion of the ileum, half an inch in length which remained just proximal to the ileocœcal valve   Each end of this isolated segment of small intestine was in close contact with a strong fibrous cord running down from the mesentery, where it was continuous with the superior mesenteric (vitelline) artery

Clockwise torsion of a segment of lower ileum round this artery as axis appeared to have taken place at an early stage of intra uterine life, causing occlusion of the lumen of the ileum above and below the loop, and it the same time leading to fibrosis of the artery well up into the mesentery Higher up in the mesentery the arterial arcades were normal, but opposite the isolated bowel they were deficient

Microscopical sections of the isolated coil of ileum (*Fig* 95) showed a normal muscular and peritoneal coat, with considerable *exfoliation of the mucosa*, so that the glands of Lieberkuhn were only here and there recognizable
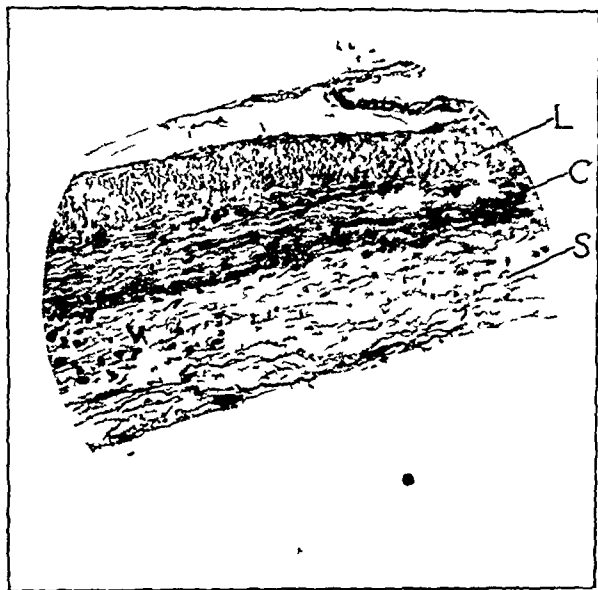
IIG 95 —Transverse section through wall of isolated coil of ileum   L   Longitudinal muscular coat   C Circular muscular coat   S Submucosa

Etiology —The whole subject of congenital intestinal atresia was dealt with exhaustively in 1904 by H S Clogg,[1] who gives a survey of the literature to that date   I do not propose to cover the same ground in this communication, but rather to discuss any light that may be thrown on the obscure question of etiology by a consideration of the two cases recorded above Clogg's summary of his conclusions on etiology may be quoted, and the reader referred to his paper   He states " that most, if not all, malformations in the duodenum are associated in some way with the development of the large glands from this region ,   that many single occlusions of the small intestine are referred to Meckel's diverticulum   that snaring of intestine by the umbilical ring accounts for some cases, and probably this is of more importance than has hitherto been thought ,   that volvulus no doubt accounts for a few cases ,   that there is no satisfactory evidence that intestinal ulceration has anything to do with atresia ,   that fœtal peritonitis has a very limited, if any, application in the cause ,   and that the unusual cases where multiple points of atresia or stenosis exist are very difficult of explanation and probably depend on different causes acting together '

A most comprehensive study of the relative frequency of congenital atresia in different parts of the intestinal tract was made by Forssner in 1907 [2]   He classifies the cases into three groups   *Group I*, in which a simple diaphragm of mucous membrane across the lumen of the bowel causes either complete occlusion or stenosis , *Group II*, in which a breach of continuity of the bowel is found, with two blind ends united by a cord ,   and *Group III*, in which the breach of continuity is complete, and the two blind ends are free and unconnected   The distribution of Forssner s collected cases was as in the appended table   It is evident from these figures that my *Case 1*, with atresia of the ileocœcal valve, is a rare anomaly, and that *Case 2*, with occlusion of the ileum, falls into a much larger group

Group I —(Diaphragm of mucosa)

Duodenum	17	(9 atresia,	8 stenosis)
Jejuno ileum	20	(16 ,,	4 ,,)
Ileocæcal valve	4	(2 ,,	2 ,,)
Colon	8	(7 ,,	1 ,,)

Total 49 (34 atresia, 15 stenosis)

Group II —(Blind ends connected by band)

Duodenum	16	(11 atresia, 5 stenosis)
Jejuno ileum	19	(all atresia)
Ileocæcal valve	4	(all atresia)
Colon	1	(atresia)

Total 40 (35 atresia, 5 stenosis)

Group III —(Blind ends unconnected)

Duodenum	13
Jejuno ileum	19
Ileocæcal valve	8
Colon	5

Total 45

A survey of the recorded cases of congenital occlusion of the ileocæcal valve leads one inevitably to the conclusion that a number of these rare cases may have been published as obstruction of the bowels from undeveloped large intestine in the new-born The attenuated, pale, and empty colon presents such a contrast with the greatly distended ileum that, without meticulous care in investigating the condition of the ileocæcal valve, it might readily be supposed that the essential error in development lay in the insufficient calibre of the colon Such an interpretation may reasonably be placed upon several records, as for instance that of Hadra [3] Similarly, in *The Lancet*, 1859,[4] there is recorded a case of fatal obstruction of the bowel by meconium, in which I would venture to suggest that the ileocæcal valve may have been really at fault The presence of tough, inspissated meconium in the lower ileum of my *Case 1* suggested this causation, until careful examination with a probe post mortem demonstrated the atresia of the valve At the same time it cannot be denied that inspissated meconium, possibly held up by a stenosis of the valve in the first place, may cause the obstruction, since such a case has been reported by Pearce Gould [5]

Causation of Atresia of the Ileocæcal Valve —If we accept, as I think we may, the conclusion of Clogg that there is no satisfactory evidence that intestinal ulceration in utero plays any part in congenital atresia, we are driven to inquire whether there is any embryological evidence of an early stage of development in which the ileocæcal valve is normally occluded Could such a phase be established, we should have a simple explanation of occlusion of the ileocæcal valve as an error in development comparable with the persistence of the proctodæal plate in imperforate anus

Tandler[6] was the first to point out that the duodenal lumen in human embryos of thirty to sixty days normally is more or less completely obliterated Forssner[2] confirmed Tandler's observations, and agreed with Tandler that the cause of the occlusion was the resistance exerted upon the expanding epithelium by the surrounding mesenchyme He also considered it probable that an epithelial occlusion, of similar origin to that occurring normally in the duodenum, may exceptionally be found in all parts of the embryonic intestine Keibel,[7] in an embryo of 11 5 mm , found that " the epithelium of the lower portion of the intestine blocked the lumen at two small places ", but since similar conditions were not observed in other specimens, he concluded that " this may well be only a chance and meaningless adhesion "

It may be concluded from the above investigations that there is some definite embryological evidence that a state of occlusion, exactly similar to that normally occurring in the duodenum, may occasionally be found, in the early months of development, in the

lower ileum   The persistence of such a rare developmental anomaly would provide the most reasonable explanation of these very uncommon cases of occlusion of the ileocæcal valve   Histological examination of the ileocæcal valve in my case (*Fig* 92) undoubtedly supports this view, since the section through the centre of the occluded valve shows a normal ileocæcal sphincter with the lumen occluded by a double layer of epithelium, and normal areolar tissue interposed   There is none of the fibrosis that would be expected if the occlusion had resulted from localized intestinal ulceration

Causation of Occlusion in Case 2—The fact that the torsion *which led to isolation of some loops of ileum in this case* occurred round the superior mesenteric artery (*Fig* 94) is conclusive proof that the very apex of the U shaped mid gut loop was involved, since the superior mesenteric is identical with the vitello-intestinal artery of the embryo A review of the recorded cases of congenital atresia of the ileum shows that it is this apex *of the mid-gut loop—the site of Meckel's diverticulum, or its earlier stage, the vitello intestinal duct—which is the commonest site of the atresia*

Clogg (loc cit) urges that volvulus should not be accepted as the mechanism involving the atresia in these cases without clear evidence that it has occurred   It is probable that the process of atrophy and disappearance of the vitello intestinal duct, carried to excess, may be a cause of stenosis or atresia in this situation without any volvulus   On the other hand, it is possible that volvulus, causing separation of a loop of bowel at an early stage, may be followed by complete disappearance of the isolated loop, and that this may explain some of the recorded cases, with wide separation of two blind ends of ileum opposite a V-shaped gap in the mesentery   Such a case is illustrated in an article by Keith [8]

Waterston[9] *describes the case of a female child, operated on by Stiles, in which the* small intestine ended blindly above a V shaped gap in the mesentery   Five inches of the lower ileum were " twisted in a spiral fashion round a peritoneal cord, which proved to be a portion of the mesentery which had apparently occupied the V-shaped gap previously described "   The last three inches of the ileum were normal, and mounted on a normal mesentery   Waterston suggests that the spiral twisting of the coil of ileum to the extent of three and a half turns was subsequent to its division by the peritoneal band , but a more likely interpretation of the case would seem to be that a volvulus was the primary event, and that *this caused separation of a portion of bowel and mesentery   If this* interpretation is correct the case is very similar to mine

Carwardine[10] described a case of atresia of the ileum in which a Meckel s diverticulum alone had undergone volvulus   The isolated Meckel's diverticulum formed a large cyst, but the mechanism by which the occlusion of the bowel was produced was evidently similar to that obtaining in my case   A very similar effect may be produced occasionally by the snaring of a loop of ileum in the umbilical ring, as in Clogg's first case   Clogg considered that the loop involved did not recede from the umbilical cord into the abdomen, owing to some adhesion of a Meckel's diverticulum to the amnion in the third month of intra-uterine life, and that this allowed the contracting umbilical ring to trap it and isolate it from the rest of the bowel

Since the isolated coils of ileum in my case contained only a trace of mucus, it may be concluded that the volvulus occurred before any appreciable quantity of meconium had reached the lower ileum   This fact gives an indication of the date at which the volvulus took place, since Low[11] has shown that meconium reaches the ileocolic junction *in the fourth month , and there is evidence from the normal disposition of the colon in the abdomen that the torsion occurred after the rotation of the mid-gut loop at the* beginning of the third month

The atrophic condition of the isolated coils is attributable to two factors, viz —

1 The absence of septic organisms in the lumen
2 The loss of blood-supply resulting from obliteration of the *superior mesenteric* artery

A striking contrast with this condition *of early intra uterine volvulus of the ileum* is afforded by *the following case*

Case 3—**Volvulus of the Ileum in a New-born Child**

A male infant, 2½ days old, was admitted to St Mary's Hospital, Dec 3, 1920, with a history that it had passed no meconium since birth

ON ADMISSION —The child was very small and in feeble condition The abdomen was very distended, and the superficial veins were engorged There was some œdema of the lower abdominal wall On rectal examination the anus was normal, and the examining finger passed up about two inches, when the rectum appeared to become much narrower

OPERATION —The abdomen was opened through a left rectus incision A greatly distended stinking, and gangrenous coil of the lower ileum presented At the lower end of the gangrenous coil there was a sharp kink of the bowel, due to old fibrous adhesions left by some localized intra-uterine peritonitis No meconium had passed beyond this kink, and the colon was in the same pale, contracted, and diminutive state is in the two cases recorded above The gangrenous coil was rapidly cut away, and enterostomy performed The child died a few hours later

In this case the overloaded coil of ileum evidently became twisted during the process of parturition or shortly after, and enough bacteria were present in the meconium to determine gangrene and putrefaction

In considering the mechanism of the volvulus in *Case 2*, it is not easy to explain why an *empty* coil of bowel should have undergone torsion with such serious results The torsion occurred, however, at a period when the great omentum was actively engaged in contracting adhesions to the colon, and securing its fixation in the position peculiar to orthograde mammals The firm adhesions of the omentum to the isolated coils of ileum in this case suggest the possible explanation that the omental adhesions perpetuated a chance position of the affected portion of the ileum, in which the blood-vessels of this segment of bowel were occluded This occlusion would naturally be most complete at the extremities of the loop, where complete division of the bowel occurred It is possible that complete disappearance of the whole segment of bowel would have followed, but for a secondary vascular supply derived from the adherent omentum

Symptoms and Diagnosis—The characteristic symptoms of congenital occlusion of the ileum are (1) Failure to pass meconium and (2) Vomiting, which may not begin until the child is some three days old There may be a slight discharge of stringy tenacious mucus from the colon below the obstruction, particularly if energetic measures such as enemata have been employed This mucus may be tinged with yellow if the child is jaundiced, and those in attendance may draw the erroneous conclusion that the obstruction is not complete There is, however, no real resemblance between this scanty viscid mucus and the greenish-black meconium

On physical examination the anus is found to be normal, and the examining finger passes readily through a normal anal canal into a rectum which is decidedly narrow, although a lumen can be felt The abdomen is distended, and the distention is of the central type, without any bulging in the flanks If the child is thin, distended coils of small intestine in visible peristalsis may be seen

Vomiting, when it has begun, is repeated at frequent intervals, and the child brings up considerable quantities of meconium, and is unable to retain fluids in the stomach

The condition must be differentiated from (1) *Imperforate anus* , and (2) *Occlusion of the duodenum*

1 In imperforate anus there is either a complete absence of the proctodæum, or, if the proctodæum is present, the examining finger is unable to pass through the anal canal owing to the obstructing proctodæal membrane There is little possibility of confusion with the condition under discussion

2 In congenital occlusion of the duodenum, vomiting is an earlier and more urgent symptom, and the dilatation above the obstruction is confined to the stomach and upper duodenum In those cases in which the occlusion is above the ampulla of Vater, meconium may be voided normally, and there will be no bile in the vomited material

Congenital occlusion of the jejunum and the rare cases of occlusion of one or more segments of the colon, can hardly be differentiated from occlusion of the ileum before operation

Prognosis and Treatment —So far as I can ascertain from the literature, no case of congenital occlusion of the ileum has survived operation more than a few days, and without operation the condition is of course rapidly fatal

The ideal of restoring the continuity of the gut, by anastomosing the dilated ileum above the obstruction with the colon below, must be set aside as futile   The tiny contracted colon, with a lumen that will only admit a probe, can never discharge its proper functions   This anastomosis has been attempted in several recorded cases, but has had to be abandoned, or has failed, in every case

Enterostomy through a convenient part of the abdominal wall is the only primary operation that should be undertaken, and there is no apparent reason, given early diagnosis, and operation before the child is exhausted by vomiting, why a small minority of cases should not survive

The presence of a normal anal canal and sphincter leads one to suggest that in a case that had survived the enterostomy and showed signs of a fair vitality, it might be worth while to re-open the abdomen a few weeks later, free the ileum from the abdominal wall, incise the rectum, and bring out the ileum through the dilated rectum and anal canal This operation would afford some hope of sphincteric control   It is too severe a proce dure to be attempted as a primary measure, in the presence of acute obstruction, and was only undertaken as a forlorn hope in my first case, when the laceration in the upper rectum was discovered

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THE KONDOLÉON OPERATION FOR ELEPHANTIASIS.

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UNTIL the year 1911, the literature dealing with the treatment of elephantiasis of the limbs is either a confession of failure, or a description of barren methods which have been discarded In that year Lanz, of Amsterdam, described an operation which he had performed on the lower limb, in a case of elephantiasis of four years standing This operation suggested to Kondoleon the method which he adopted a year later, and which forms the subject of this paper

In an elephantiasis there are two chief elements lymph stasis, and overgrowth of cutaneous and subcutaneous tissues The stasis may be caused by disease or removal of glands to which the lymphatics converge, disease of the lymphatics themselves, or disease of the blood vessels The second constituent, namely overgrowth, follows the prolonged soaking of the tissues, and may gradually become elephantine The fibrous network thickens beneath the skin holding in its meshes enormous quantities of fat and stagnant lymph the skin, responding to the stress coming from within, becomes coarse like that of an elephant, and the disease thus twice justifies its name

Lanz was the first to recognize the deep fascia as a barrier to lymph absorption Impressed with the fact that, save at their common glandular terminations, the deep and superficial lymphatics of the lower limb make few anastomoses, he recognized the deep fascia as a kind of watershed separating these two lymphatic systems On this assumption he incised the deep fascia on the outer side of the thigh, exposed the femur behind the vastus externus, and introduced strips of fascia between the muscles, in order to effect a drainage of the subcutaneous lymph-swamp into the deep catchment area of the muscles

Thinking the bone-marrow might afford an additional area of absorption, he also introduced pedicled strips of fascia into the medullary cavity through holes drilled in the bone He then closed the skin without drainage Immediate diminution in the size of the limb resulted, and three years after the operation this improvement was maintained

Kondoleon, as a result of operation and experiment, concluded that small slits in the deep fascia were inadequate for good drainage He also failed in a case where, following Lanz, he had introduced fascial strips between the muscles

This work, however, impressed him with the fact that the bulk of the stagnant lymph lay in the loose connective tissue immediately adjoining the deep fascia, and in two of his cases Kondoleon found this lymph-logged stratum differentiated into a distinct and separable layer He then attempted to effect adequate drainage of the subcutaneous tissue into the muscles through wide openings in the deep fascia, and with this method he succeeded in eight cases

Moschowitz, Sistrunk, and others have repeated his successes in America seventeen cases have been recorded in all

It seems to me that the presence of connective-tissue overgrowth, dividing as it does the subcutaneous area into a loculated mass, does much to explain the failure of the earlier operations for elephantiasis Handley, for instance, has expressed the view that " lymphangioplasty has failed to establish its position in the treatment of this disease " This conclusion is not unnatural, for, if the subcutaneous area is become in any degree ilveolar, attempts at permanent drainage by means of silk strands must be futile One might as well try to drain all the honey from a bee-hive by running a couple of threads through the combs

This loculation of the subcutaneous lymph into little pools explains why in old-standing cases cures are not complete , for only the pools in the immediate neighbourhood of the openings made in the deep fascia will be tapped, leaving a vast lacunar swamp undrained

This, I believe is the explanation of Kondoleon s success with wide openings in the deep fascia, and I think it follows that in an old-standing case, openings should be made in each area where drainage is desired   for in such a case, drainage will be purely local, and resection, for example of the fascia lata while it will drain the adjacent tissues of the thigh, will not relieve the lymph stagnation in the leg

Handley s successes with lymph-angioplasty in the treatment of œdema of the upper limb following cancer of the breast are explicable, perhaps, by an absence of subcutaneous loculation for, by comparison with many cases of elephantiasis, the œdema in cancer is of short duration   the subcutaneous pools communicate and the threads drain them all

In April, 1917 I had an opportunity of putting Kondoleon s operation to a severe test   The patient, a French woman, age 34, with three healthy children gave a negative family history, and a vague account of some kind of inflammatory trouble in her right leg at the age of seven   She had always lived in France   For twenty-seven years the limb had gradually been increasing in size   Fig 96 which is taken from a photograph kindly given me by Mr R Atkinson Stoney shows better than description the condition as it was in 1916 one year previous to operation   When I saw her for the first time a year later, the proximal fold which appears on the inner side of the thigh had become a pouch and hung down like a huge scrotum almost to the level of the knee greatly impeding her gait
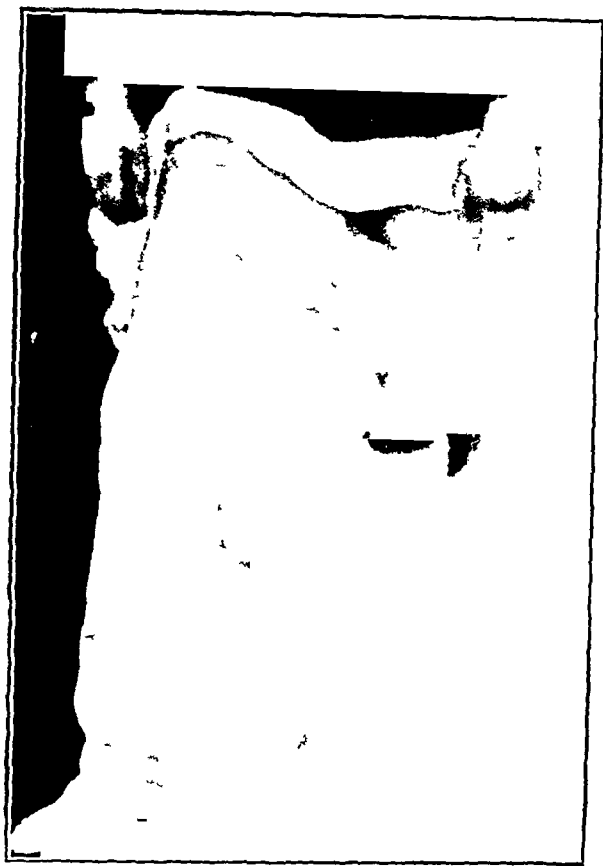
Fig 96 —Showing the condition one year previous to operation During this period the proximal fold in the right thigh had become pedunculated and at time of operation hung down almo t to the level of the knee

This indeed, was her chief complaint and she came to request its removal   She also complained of attacks of shivering followed by fever occurring about once in four months   During these attacks, which lasted for three or four days, the limb became red painful and more swollen than usual   The skin of the affected limb was harsh, dry, and greyish-brown, except in the creases of the skin folds, where it was pink and moist   The foot was quite unaffected   For about a week before operation the patient was kept in bed   At the end of that time there was practically no diminution in the size of the limb

At operation I first amputated by an elliptical incision the scrotal like swelling which hung down almost to the knee and then excised a hand s breadth of the deep fascia subtending its base together with the greatly thickened subcutaneous tissue which lay at the periphery of the wound   The skin was closed over the bared muscles with mattress sutures

of silkworm gut, threaded on either side through rubber tubing, and also with interrupted skin sutures of the same material An incision including a wide strip of skin was then made along the whole length of the outer aspect of the thigh, and a hand's-breadth of deep fascia of the length of the incision was resected together with as much subcutaneous tissue as was accessible This wound was completely closed like the first The deep fascia was about a quarter of an inch thick, and was 'felted' on its superficial aspect The wounds healed without incident, except that, from the upper end of the inner incision, clean lymph oozed freely at first This oozing had ceased by the fourteenth day
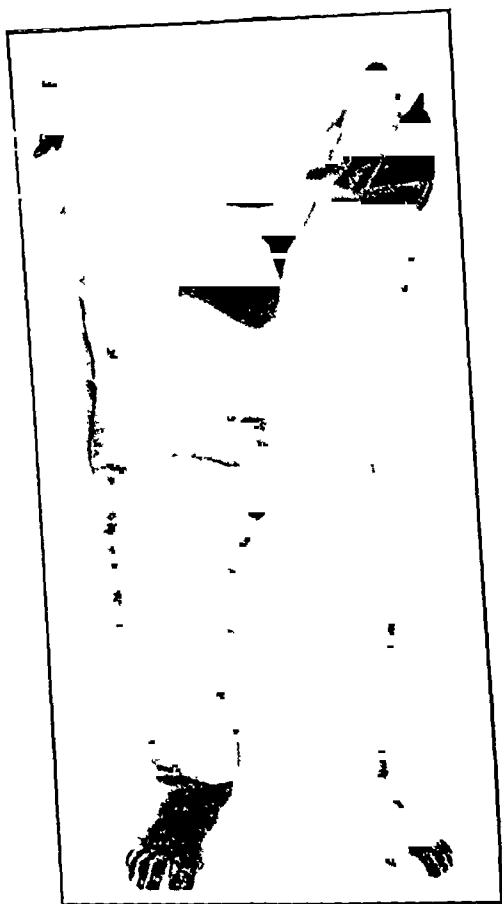
FIG 97 —Showing the condition 11 months after the first operation and 4 months after the third operation
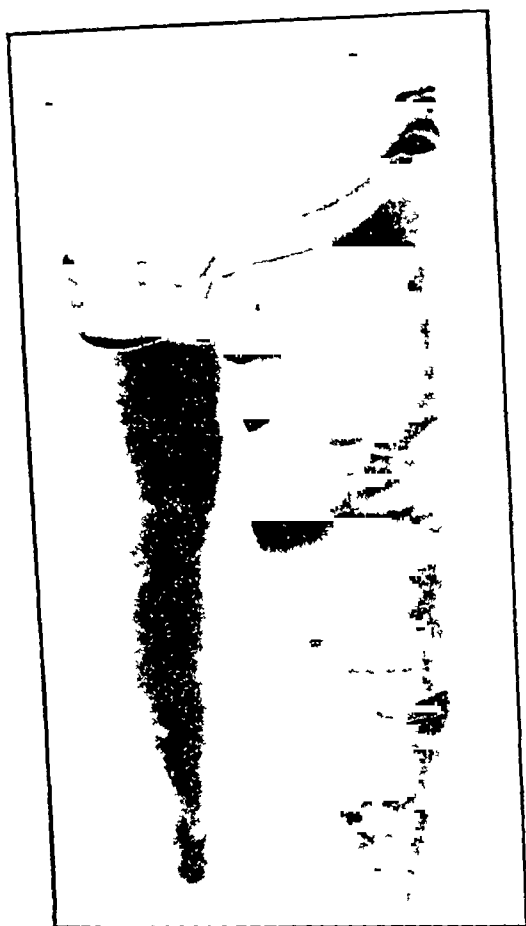
FIG 98 —Same as *Fig* 97 Posterior view

A month after the first intervention I again operated, using the same technique On this occasion the huge oblong cushion along the lower two-thirds of the inner side of the thigh was removed

This time, in closing the wound, sutures were passed so as to pick up the exposed muscles and bring them into contact with the subcutaneous tissue The wound on this occasion took slightly longer to heal, continuing to discharge lymph at one point for three weeks

When I saw the patient again, five months later, in November, 1918, she was so pleased with the results of the first two operations that she asked me to try to improve the remaining condition

On Dec 9, 1918, we decided that in view of the extensive resection contemplated,

time would be saved if, while one of us dealt with the enormous cushion of elephantoid tissue that persisted over the hamstrings from the popliteal space to the gluteal fold, the other excised the great wad extending over the calf to the ankle   This was done with the patient in the prone position, Dr D Milne Henry operating on the leg, whilst I worked on the thigh

Figs 97, 98, 99 show the condition of the patient four months after this last operation, and eleven months after the first   The long duration of the condition in this case makes it a severe test of Kondoleon's method

I would repeat that the drainage effected is a *local* drainage, and although, as the illustrations show, the limb is still much larger than its fellow, it is considerably smaller than it was, and the condition has not recurred in the areas of operation, where previously it was progressing fast

While appreciating to the full the practical merit of Kondoleon's procedure, it is difficult to agree with the theory on which it is based Kondoleon assumes that, by resecting deep fascia, he allows the subcutaneous lymph to drain into the deep lymphatics   I submit that if the actual result of this resection were to throw the task of drainage upon the deep lymphatics, Kondoleon's operation would often fail in the very cases where it has succeeded best   Kondoleon claims that his most satis factory results have been obtained in cases of elephantiasis due to filarial infection   Now in this disease the filarie are not confined to a single group of glands, such as those which drain the superficial lymphatics of the lower limb, but are distributed throughout the lymph atic system of the pelvis   Of these pelvic glands, those grouped about the termination of the external iliac artery receive the efferent lymphatic vessels, not only of the superficial inguinal glands, but of the deep inguinal glands also   It is most unlikely that the widespread invasion which is blocking the superficial inguinal glands will spare the adjacent glands of the external iliac group, which are the ultimate goal not only of the main lymphatic inflow from the thigh, but of *all* the lymph carried by the lymphatics of the leg, both deep and superficial *
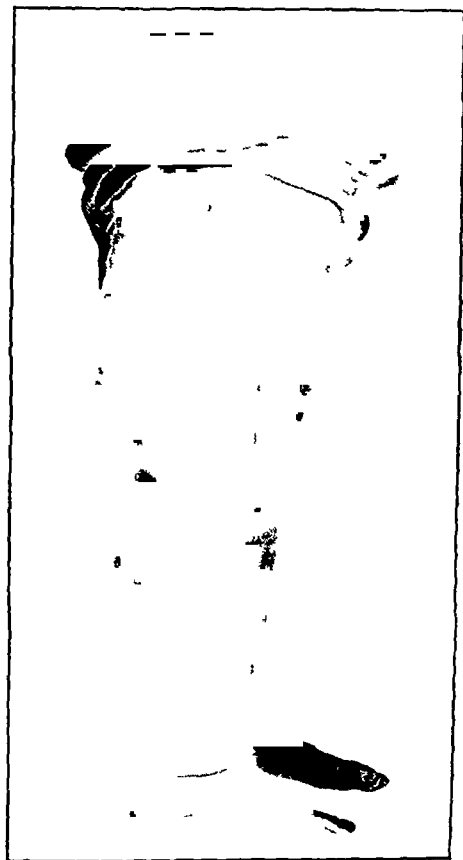
Fic 99 —Lateral view taken at same time is Figs 97 and 98

The success of the operation makes it difficult to believe that the drainage actually established in these cases can be by way of the deep lymphatics, since the glands to which these deep vessels converge are just as likely to be impermeable as those which are blocking the outflow from the superficial lymphatics

Again, in the upper limb, with the exception of those superficial vessels which pass to the infraclavicular glands, the superficial and deep lymphatics converge upon the same

* Kondoleon himself describes a successful result obtained by his operation in a case of elephantiasis due to *complete* removal of the inguinal lymph glands   Here both superficial and deep lymphatics would presumably be blocked at their extremities and it would thus be useless to drain the territory of one set into the other   But it is perhaps unfair to take his complete in the strictly anatomical sense of including both the superficial and the deep inguinal glands

group of axillary glands—the lateral or brachial group, which lies in relation to the axillary vessels A removal of fascia from the upper limb would, on Kondoleon's theory, seek to divert the lymph to the very group of glands whose impermeability was blamed for the disease

It might, of course, be objected that superficial and deep vessels of the upper limb may be received respectively by separate members of the group to which they pass, and that a path for the deep lymph might remain clear through certain fortunate glands of the group which were still permeable It is difficult to accept this explanation, in view of Sistrunk's success with Kondoleon's operation in a case where elephantiasis of the upper limb followed a clearance of glands from the axilla It is extremely improbable that, in this case, a deep lymphatic path persisted through any glands of the common brachial group, which receives both sets of lymphatic vessels and it would be deliberate imprudence to perform any operation which depended for success upon so slight a possibility

By what channel, then, is the lymph absorbed which passes through the openings cut in the deep fascia ?

Starling, in the last edition of his *Principles of Human Physiology*, states that *rapid* absorption of substances injected into the tissues takes place by way of the blood-vessels If strychnine is injected into the distal part of a limb, symptoms of poisoning occur almost as rapidly after section of all the tissues of the limb except the main artery and vein, as if a normal limb is injected Again, if methylene blue is injected into the pleural cavity or subcutaneous tissues, the dye appears in the veins long before any trace of colour can be perceived in the lymph flowing from the thoracic duct I think it is clear, therefore, that in cases of elephantiasis due to the blocking of lymph-glands, and treated by Kondoleon's method, the superfluous lymph is absorbed by the blood-vessels of the muscles and not by the deep lymphatics It should be noted, however that one case of elephantiasis operated on by Kondoleon was attributed to venous obstruction , and one may assume with MacCallum (*Text Book of Pathology*, 2nd edition, p 44) that the lymphatic and venous outflow from a part are, in a sense, alternative if the veins of a limb are tied, the flow of lymph from the lymphatic trunk is greatly increased

It is a little difficult, however, to understand why it is that the blood-vessels of the muscles should be competent to carry off the superfluous lymph, while those of the skin and subcutaneous tissue, which are so numerous in elephantiasis, are unable to remove it Without venturing into the very controversial question of lymph formation and œdema, it seems to me that there may possibly be a simple physical factor which makes absorption easier for the blood-vessels in the muscle strata than for those under the skin

The subcutaneous tissue, as I have said, tends in elephantiasis to fibrous intersections, which divide the lymph into pools , whereas the muscular strata in the limbs afford intervals in which a fluid might, as it were, be moulded into delicate laminæ and take the cast of the capillary interstices of the muscles Presumably blood-vessels would more easily deplete these intermuscular pellicles than they would pools in the subcutaneous tissues

To test this hypothesis of physical facilitation, I injected a coloured fluid into the limb muscles of a dead rabbit Contrary to my expectation, I found that when the limb was skinned and viewed by transmitted light, the fluid, when injected into a muscle belly, formed a globular drop and did not spread between the fibres of the dead muscle

Very different, however, was the effect of making an extramuscular injection under the deep fascia, or under the muscle-sheath A wide and instantaneous spread was observed like that of a drop between a glass slide and its cover-slip A similar spread, no less swift, but columnar rather than laminar, was seen on injecting the intermuscular spaces, especially those adjacent to the long bones of the limb It is very possible that this physical facilitation of absorption in the muscle strata contributes to the success of the Kondoleon operation

Apart from the protoplasmic phenomena, there is in all probability a dynamic part played by the muscles themselves in pumping lymph from the stagnant subcutaneous

swamp into the absorbent strata of the muscles   It may be argued that the opening cut
in the fascia is soon blocked by dense fibrous tissue, but a consideration of three
suggestive facts inclines me to doubt that this necessarily occurs   In the first place,
every one is familiar with those tedious wounds which expose the extensor muscles in the
leg, and are kept patent by the shearing stress exerted by their contractions   Secondly,
muscle herniæ are very common after wounds of the deep fascia   Observation of these
herniæ leads me to conclude that they are especially prone to occur where the wound in
the skin is of smaller extent than that in the fascia, or where the superficial tissues have
healed *rapidly* over the fascial defect, and this is precisely the condition secured in the
Kondoleon operation by suturing the skin   Thirdly, in using local anæsthesia in operations
for inguinal hernia, I have often observed that the solution which I have injected into
subcutaneous tissue, and into subcutaneous tissue only, has penetrated all the coverings
of the hernia, and has anæsthetized the neck of the sac without any supplementary
injection being made   In cases of muscle herniæ the fascial defect is so thinly patched
that during contraction the muscle belly bulges freely, like an abdominal hernia into its
sac, and there is certainly no reason to suppose that the thin coat of a hernia is less
permeable to fluids when it contains muscle than when it contains gut

I would suggest, then, that Kondoleon's operation actually produces a series of wide
muscle herniæ, and that the alternate bulging and withdrawal of the muscles at the fascial
openings probably serves to aspirate fluid from the subcutaneous tissue into the muscular
strata

During contraction, a muscle like the biceps must tend to cause a negative pressure
in those parts of the intermuscular spaces from which it recedes, while at the same time
raising the pressure where it expands   If, then, an opening is made in the fascia covering
the muscle belly, lymph will be aspirated through this opening when the muscle elongates
During contraction the muscle bulges into the opening, and closes it against the egress of
the aspirated lymph   This lymph is then distributed under positive pressure in thin
pellicles or slender columns to the extremities of the muscle, where a negative pressure
has developed during the contraction of its belly

In actual practice, of course, the relative positions of the contracting belly and of the
fascial opening will often make this muscle-pump a leaky and defective instrument   On
the other hand, it is impossible to deny the importance, in treating elephantiasis, of any
factor which secures, if only for a moment at a time, the repeated influx of lymph into
a region with a special faculty for absorption, and where experiment shows that even
after death fluids will easily spread

I hope, in this connection, to deal in a later paper with experiments upon muscle
herniæ, and the nature of repair and absorption at fascial openings

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INJURIES OF THE DIAPHRAGM :
WITH SPECIAL REFERENCE TO ABDOMINOTHORACIC WOUNDS *

By C W GORDON BRYAN London

Injuries of the diaphragm are of consequence partly on account of the important physiological functions in which the muscle is engaged, partly because of its close anatomical relationship to important viscera of the abdomen and thorax The effects of such injuries have been met with much more commonly in recent years than in previous times, and the reasons for this are clear   street accidents, so frequent in these days of motor transport, are responsible for most of the cases seen in civil life, and the great War with the numerous smaller wars that have succeeded it, have brought a very large number of cases under the care of military surgeons As a weapon of revenge the popularity of the dagger has waned, but the revolver has a prominent place in methods of reprisal, and the diaphragm often suffers In the cases usually met with in civil surgery, the muscle is ruptured as a result of crushing violence, whereas injuries seen in military surgery are commonly produced by an open wound

Each of these types of injury produces consequences of surgical importance at two stages—an early stage in which serious symptoms follow immediately after the injury, and a late stage where the patient suffers from certain special complications months or years afterwards

I propose, then, to consider the subject of this lecture in two parts, dealing first with the early effects of injuries of the diaphragm, and afterwards with their late effects

EARLY EFFECTS OF INJURIES OF THE DIAPHRAGM

Injuries without an External Wound —When the diaphragm is injured by severe external violence in the nature of a crush, it may be ruptured by a stretching and bursting mechanism, or it may be torn by the sharp end of a fractured rib , such cases are of two types, according to whether the vault or one of the crura of the muscle is implicated

Rupture of the Vault of the Diaphragm —Rupture of the vault is a commoner lesion than rupture of a crus, and is usually due to a person being run over It occurs most frequently in children and adolescents, because their thoracic skeleton is elastic, and can be compressed to a considerable degree without fracture In adults, on the other hand the force of such crushes is met by the more rigid bones and cartilages and the less mobile viscera, so that the usual results are fracture of ribs, rupture of abdominal viscera, or in association of both these elements Most of the cases of this injury in adults have been complicated by fractures of the lower ribs of both sides

The mechanism of simple rupture of the diaphragm is of interest , and in this connection I have had convincing personal proof of the amount of compression and displacement that the thoracic wall and upper abdominal viscera can withstand without harm for it the age of eighteen it was my fortune to be run over by a motor-bus, weighing about two tons and containing six people, the back wheel passing over the right hypochondrium and lower chest, across the sternum, and the left shoulder After the accident no lesion was discoverable, until the right side of the chest-wall fell in three days

later, as a result of the separation of the attachments of the right costal cartilages   Two years ago I saw a precisely similar condition in a girl of three years, run over by a car which passed obliquely across the left hypochondrium and right chest, and caused no apparent injury beyond costochondral dislocations

E T , a girl, age 3 years, was admitted to St Mary's Hospital, Sept 13, 1919, immediately after being run over   Temperature 98°, pulse 132, respiration 32   Right thoracic wall displaced forwards , 'clicking' sound audible at each respiration , no other abnormality detected on per cussion and auscultation , abdomen rigid on palpation, but moving well with respiration , lips cyanosed

Treated by strapping chest, after applying a pad to right of sternum   On the next day there were no abdominal signs or displacement of the heart, and the child went home in good condition on the sixth day

Such escapes are to be considered fortunate, for it is by similar violence that rupture of the diaphragm is caused

PATHOLOGY —A tear of the right side is very uncommon owing to its relation to the liver, which, being comparatively immobile, has to bear the brunt of a compression injury of this region , a tear of the diaphragm associated with rupture of the liver is overshadowed by the more serious injury, and is only of clinical importance if it causes a right sided hæmothorax   I have seen a case of severe reactionary hæmorrhage from the liver into the pleural cavity through an opening in this part of the muscle   On the other hand, the mobility and elasticity of the viscera on the left side enable them to act as a sort of air cushion and transmit the force to the stretched diaphragm, and it is ruptured , the tear usually occurs in the posterior part of the muscle, and sometimes extends into its œsophageal opening

SYMPTOMS —The symptoms at first are those of shock, dyspnœa, and disordered action of the heart   The breathing presents certain typical characters , its rate is little altered, but it is almost entirely thoracic in type, with a catch at the end of inspiration (sometimes definite spasm or hiccough) , painful and repeated cough may occur, and the lips are blue   The pulse is rapid and irregular

After about twenty-four hours the patient may recover from shock, and dia phragmatic breathing is restored by the tear becoming plugged with omentum   The left lung is usually in a state of partial collapse, but in several instances the patients have appeared remarkably free from symptoms after the first two days

The early development of a hernia of the stomach into the left pleural cavity, usually accompanied by omentum and transverse colon, gives rise to vomiting and other signs of obstruction, but with absence of distention   Dyspnœa and tachycardia recur, from displacement and compression of the lung and heart   Severe pain is present in two situations   in the abdomen, accompanied as a rule by moderate rigidity of the left hypo chondrium, and in the neck or shoulder—a symptom of great significance, to which Mr Zachary Cope[1] has recently directed attention in disease of the diaphragmatic peri toneum   The chest signs resemble those of hydropneumothorax

The hernia may reduce itself and recur later, it may become chronic, or it may lead to early death from shock and obstruction

DIAGNOSIS —The difficulties of diagnosis of these cases are well known, and x ray examination, even if the patient is fit for it, may be fallacious, for it is often quite difficult to persuade an opaque meal to enter the supradiaphragmatic portion of the stomach

TREATMENT —In war surgery it was pointed out first by Lockwood[2] that the cardiac and respiratory embarrassment of wounds of the diaphragm was very similar to that of open pneumothorax, and that the condition of patients improved as soon as the com munication between thorax and abdomen was closed   It seems to be essential that the central tendon of the diaphragm be anchored if the heart is to escape embarrassment, and a communication between pleura and peritoneum heavily handicaps respiration   It is this consideration that makes early operation of importance in cases of simple rupture of the muscle , and the poor condition of the patient is no contra-indication, for the rapidity

of the pulse, being partially due to mechanical causes, is no criterion of the degree of shock

The left side of the diaphragm may be approached from above or from below Judging chiefly from an experience of war injuries, I prefer the thoracic route, as it gives an easier access for the reduction of viscera, for dealing with associated injury of the spleen or cardiac end of the stomach, and for closing the defect in the diaphragm, but in some cases signs of rupture of intestine make an abdominal incision preferable

A case admitted to St Mary's Hospital illustrates the early effects of simple rupture of the diaphragm

D G, a girl, age 5 years, was run over by a taxi cab on Jan 8, 1917 Vomited immediately, and soon after admission twice vomited a small amount of blood and mucus

Severe shock, lying on left side with knees drawn up, abdomen, extensively bruised, immobile No signs of fractured pelvis, internal hæmorrhage, or ruptured viscus

After forty eight hours condition good, taking ordinary food, six days later, half an hour after dinner, severe pain in abdomen and back of neck, and any food was vomited at once On seventh day signs of fluid and air in left chest, heart apex-beat 1 in to left of sternum, pulse feeble and rapid, temperature 96° Vomiting after ill food, severe pain in neck Symptoms abated next day, but recurred on tenth day

Diaphragmatic hernia diagnosed by surgeon, but x rays showed bismuth passing normally below diaphragm, and radiographer considered the case hydropneumothorax Extreme collapse precluded exploratory operation, and death occurred on eleventh day

Autopsy—Tear of left part of tendon of diaphragm, whole stomach, omentum, and part of transverse colon in left pleural sac, tear of peritoneal coat of stomach, which was greatly distended and contained bile retroperitoneal hæmorrhage round right suprarenal body and duodenojejunal flexure Left lung completely collapsed

The alternating periods of severe illness and apparently normal health made the case one of great difficulty, the hernia evidently had reduced itself after its first appearance, only to recur with fatal result

Rupture of the Crus of the Diaphragm—Rupture of the crus must be an uncommon injury I have seen one example, in association with fracture of the spine The diaphragm injury was of clinical importance, as it gave rise to great respiratory distress, and intraperitoneal hæmorrhage which simulated rupture of a viscus In such a case one cannot delay for the presence or absence of peritonitis to settle the diagnosis Having diagnosed injury in the neighbourhood of the crura of the diaphragm, with possible rupture of the duodenum, exploration was undertaken, under gas-oxygen The abdominal wall was infiltrated with novocain (0 25 per cent), and a left paramedian incision, carried outwards through the left rectus opposite the umbilicus, gave good access with the minimum of retraction—so frequently the cause of operative shock The diaphragm, the cardia, and the duodenal region were examined thoroughly, and the bleeding was controlled with a fair degree of ease

C R, male, age 40, fell more than thirty feet, landing on pavement in sitting attitude, on April 1, 1920 Admitted at once to St Mary's Hospital suffering from severe shock, compression fracture of the 11th and 12th dorsal vertebræ and fracture of pelvis, signs of intrathecal bleeding developed later, pain and weakness of legs, with anæsthesia to level of left knee

Five hours later, vomiting of altered blood, severe abdominal pain Temperature 98°, pulse 104, respiration 22, shallow, of thoracic type, with catch at inspiration, alæ nasi working, small area of rigidity, right upper rectus

Operation—Rupture of internal part of left crus of diaphragm from which, and from œsophageal branches of coronary vein, blood escaped through a tear in overlying peritoneum The bleeding was arrested, neighbouring structures examined, dilated stomach washed out, and abdomen closed

From second to fifth day, hiccough and slight vomiting Complete recovery from all injuries, leaving hospital Aug 14, 1920

Simple Laceration of the Diaphragm by a Fractured Rib—Penetration of the diaphragm by a rib which has sustained a simple fracture usually results from direct violence to the ninth or tenth rib and the bone may also lacerate the spleen or liver It is not, I think, commonly realized that this is the mode of injury in some cases classed as rupture of the spleen, and that the severity of the symptoms is partly due to

hæmorrhage, and partly also to the handicap that injury of the diaphragm places on heart and respiration   The chances of recovery are improved by closing the opening in the muscle

In dealing with a bleeding spleen through an abdominal-wall incision, considerable manipulation may be necessary, and the difficulty of exposure makes anything short of splenectomy almost impossible   Since it is known from experience of recent years that the old fear of opening the pleura was an unnecessary one, the advantages of approaching certain injuries of the spleen through the chest-wall are definite—especially injuries due to rib fracture

In the absence of fracture the tenth rib may be resected and the pleura pushed aside , if a fracture is present, the broken rib is removed, the openings in pleura and diaphragm are enlarged, and their edges sutured together to close the pleural sac   The exposure of the spleen thus obtained allows of the damaged portion being sutured or resected, pro cedures of far less severity than splenectomy , if removal of the organ is necessary, the manipulation of the pedicle, so productive of shock, can be carried out more gently than through an abdominal incision

Dealing with injured abdominal viscera by transthoracic laparotomy is not new, for in 1912 Sauerbruch[3] described three cases on whom he operated under differential pressure   in one, through an incision of the seventh interspace, he removed the spleen for splenic-vein hæmorrhage, and sutured a laceration of the lung , in another, he sutured a bullet wound of the right lung, and dealt with a wound of the liver through an incision in the sixth intercostal space , and in the third, he opened the seventh left interspace and repaired abdominal and thoracic injuries   He advised that the diaphragm be incised across, or obliquely to the direction of its fibres, to avoid phrenic-nerve injury   Bulkeley[4] dealt with a stab wound of the spleen through the diaphragm

Conclusions —It appears then that simple rupture of the diaphragm causes symptoms which may be easily overlooked or attributed to shock and hæmorrhage   Such rupture may be associated with bleeding from spleen or liver , and in operating for these con ditions the diaphragm should be examined and sutured if torn, in order to relieve the immediate embarrassment of heart and lungs and to prevent diaphragmatic hernia

Fracture of ribs causes laceration of the spleen, and the latter should be dealt with by partial resection or suture when possible, performed through a thoracic exposure

Penetrating Wounds of the Diaphragm , Abdominothoracic Wounds — While I realize that the partial cessation of war makes these injuries to some extent a matter of historical interest, at least it is recent history   In spite of all hopes, wars have not finally ceased and it is reasonable to expect that the opportunity may be forced upon some of us to return reluctantly to military surgery , moreover, in civil war, and even in peace, penetrating wounds of the diaphragm do occur from time to time

Such wounds had a very high mortality in the great War , large numbers came to casualty clearing stations, smaller numbers were seen at the base hospitals, and their severity made one realize how many deaths on the battlefield and in field ambulances must have resulted from wounds implicating the diaphragm

As is well known, it was the experience of the South African War that caused surgeons, in the earlier months of the war in France, to abstain from operation in wounds of the abdomen and active surgery was reserved for such later complications as abscess   The results of conservative treatment were soon apparent—the mortality was enormous—and in 1915 it was established that the correct treatment of wounds of the abdomen, with certain exceptions, was early operation , the exceptions were some types of wounds of the upper abdomen from which the death-rate did not seem so high

Severe wounds involving the thorax as well as the abdomen were judged to be outside the range of active surgery   in fact, as late as 1918, the translation of Abadie's book stated that ' thoraco-abdominal association is either benign, justifying simple abstention, or so serious as to render illusory the benefit of intervention in almost all cases "   At this earlier period the treatment of these wounds was little more advanced than in the time of Waterloo   Guthrie,[6] in his book which deals with the war surgery of that period

and of the Crimea, gives details of a series of cases of wounds of the diaphragm   He states that wounds of this muscle were known to the older surgeons from the time of Paré , they knew that such wounds were not immediately, though as a rule eventually, mortal , that abdominal viscera sometimes passed through wounds of the diaphragm into the thorax, and that wounds of this muscle never closed " except under rare and particular circumstances ', but were always a source of danger to life unless the liver or spleen filled the opening   He called attention to the peculiarity of the breathing—dyspnœa with a " peculiar sort of jerk or spasm "—and to the important symptom of pain on the top of the shoulder, with loss of power of the arm   In treatment he laid chief stress on the necessity for free external opening for the discharge of matter, on free bleedings and purgings of the patient, and the use of opium

In France our cases were treated at first either conservatively, or mere provision for drainage was made   Then the early operative treatment of wounds of the chest was developed, thanks to the enterprise, in the British Army, of Mr Gask, and its striking success soon led to its extension to the more severe abdominothoracic wounds , we closed instead of enlarged the wounds, blood transfusion became a routine procedure, and extensive operations of excision and repair were carried out   These wounds were very common, and this is easily understood when we bear in mind the position of the diaphragm above the centre of the body, and the large target that its sloping surfaces offer to missiles from whichever direction they approach   The conditions of warfare made them particularly serious, even in comparison with similar wounds met with in civil life

It was soon apparent that operations on the trunk, with after-treatment usually carried out in a tent, were much more disappointing in winter than summer   And at all times of the year soldiers on active service are not in good condition for surgery of this severe nature , excessive cigarette smoking, often right up to the time of operation, made the anæsthetic difficult and increased the risk of post-operative bronchitis in chest cases , while constipation added to the dangers of abdominal wounds and the difficulties of their surgery , the co-existence of both factors made abdominothoracic cases particularly dangerous

The wounds were usually due to bullets or fragments of shell or bomb , in fact, during my service as a surgeon for more than four years in France and Belgium, I never met with a bayonet wound of the diaphragm   Of a series of 50 cases, 16 were due to bullets, 34 to shell or bomb   These include all those of whom I have notes taken between August, 1917, and the conclusion of hostilities , they include all cases upon which I operated during that period   They are unfortunately only a part of those I made, for I kept records also of all wounds of the trunk admitted to the clearing station to which I belonged, but not submitted to operation owing to the pressure of more hopeful surgery   These records were lost during the rapid travelling that was forced upon us in March, 1918, and they included many cases due to bullets or small fragments of shell for whom operation appeared less urgent, as well as those of bad prognosis   Except at times when the numbers of wounded necessitated the exclusion of such cases, I thought it right to operate on the most desperate ones, not only in the hope of occasional successes, but also because a policy of despair is bad for morale   Of the 50 cases 26 were evacuated to the base, and 24 died in the clearing stations

PROGNOSIS —The prognosis in shell wounds depended partly on the size of the fragment   a man rarely reached England with a large fragment retained in thorax or abdomen   such patients either died, or had the missiles extracted in France

The most complicated case upon which I operated was wounded by a very large piece of bomb which entered the epigastrium, and, among other things, completely bisected the stomach

Case 18 —Gunner T H , wounded 7 30 a m , Dec 15, 1917   Admitted 2½ hours later with large wound of left epigastrium , collapse, dyspnœa, pulse 140   After two hours' 'resuscitation', pulse 108

Operation —Wound excised, stomach found divided into two almost equal parts, jejunum

divided, large hole in transverse mesocolon, lacerations of liver, spleen, and splenic flexure, very large projectile embedded in left dome of diaphragm, fractured ribs Foreign body removed, and stomach, jejunum, spleen, diaphragm and transverse mesocolon sutured, wound closed, splenic flexure colostomy through separate incision Death same day

This case illustrates the apparent improvement that may follow treatment by rest and warmth, and the difficulty of deciding before exploration whether active surgery can help, it was remarkable that the man reached the clearing station and lived through the operation

The most serious elements of a wound traversing the diaphragm may be (1) The actual opening in the muscle, (2) The injury of thoracic organs, (3) The abdominal lesions, (4) Severe injuries of abdominal and thoracic viscera in the same patient

The danger of the actual opening is twofold it considerably handicaps the respiration and circulation of a man suffering from shock and hæmorrhage, and it allows the escape of abdominal contents into the thorax at once or at a later date, and it enables infection to spread from below the diaphragm to the pleura, and vice versa

The thoracic injuries interfere with respiration from collapse of the lung, hæmothorax, and pneumothorax, and they may endanger life by loss of blood, sepsis, and injury of the heart The dangers of the abdominal lesions are hæmorrhage, sepsis, intestinal obstruction, and interference with processes of metabolism, such as may result from a wound of the liver

THE DIAGNOSIS of injury of the diaphragm can usually be settled in through-and-through wounds of the body by estimation of the line that the missile has taken, if the projectile is retained, its localization by x rays and the character of the breathing—thoracic in type, with a catch at the end of inspiration—are the indications of most value

The patients usually arrived at the clearing station in a condition of shock, cold and exhausted, at this stage, estimation of the blood-pressure gave a more useful indication of their state than the pulse-rate, the slow pulse of men wounded in the liver is apt to be deceptive

TREATMENT—GENERAL CONSIDERATIONS —In most cases resuscitation by rest and warmth was necessary, but prolonged delay is dangerous, the delay caused by sending special cases to special wards on arrival seemed to me a thing to be avoided, but special wards for after-treatment were of great value The primary objects of early operation in chest wounds are the prevention of sepsis and the closure of an open wound of the pleura, and the same considerations apply when the abdomen is also involved, but here the further complication of serious internal or external hæmorrhage is more often present Every hour of waiting diminishes the chances of success

Clean bullet wounds, and small through-and-through shell wounds, often did well without operation, hæmothorax being dealt with by aspiration repeated at short intervals, keeping the pleura as dry as possible In some of the lighter cases such simple operations as excision and suture of the wounds of the thoracic wall and the diaphragm were performed, especially for through and-through wounds fracturing a rib, but experience of sepsis of lung and pleura, extraperitoneal cellulitis, and abscess of the liver convinced me that thorough cleansing, or excision, and repair of the whole track of the missile, especially if it was retained was the safer policy Conservative surgery should be reserved for special times, such as cold weather and shortage of stoves Radical treatment is specially necessary where a wound is due to a projectile of any size, for lacerated muscle and fractured bone will surely become infected if not excised, a large projectile usually carries in cloth, and if retained in a viscus always causes infection, a large wound of the thorax remains open, or if closed at first will re open, producing the conditions known as sucking and 'leaking' wounds, and a large wound of the diaphragm by remaining open impedes the action of heart and lungs, and is likely to lead to diaphragmatic hernia

The severity of the patient s general condition is no bar to active surgery, for, to a man who appears very ill soon after the receipt of a wound of the diaphragm, operation usually holds out the only hope of recovery, and it is often impossible to estimate to what extent symptoms are due to hæmorrhage, to mechanical interference with thoracic

viscera, and to hernia of abdominal contents, all of which can be corrected by early operation

OPERATIVE METHODS —Two general methods of operation for abdominothoracic wounds have been employed by different surgeons —

A Operation through an abdominal incision, repairing the diaphragm from below, and dealing with the visceral lesions , a separate incision of the thoracic wall being made, if necessary, for repairing the intrathoracic injuries

B An incision through the lower part of the chest wall, carried forwards and downwards into the abdominal wall in certain circumstances , the wound of the diaphragm is excised and repaired, and the lesions of thoracic and abdominal viscera are dealt with through the one incision

It has been found possible to deal with most of the abdominothoracic wounds by the latter type of operation, and I will give a general description of its stages
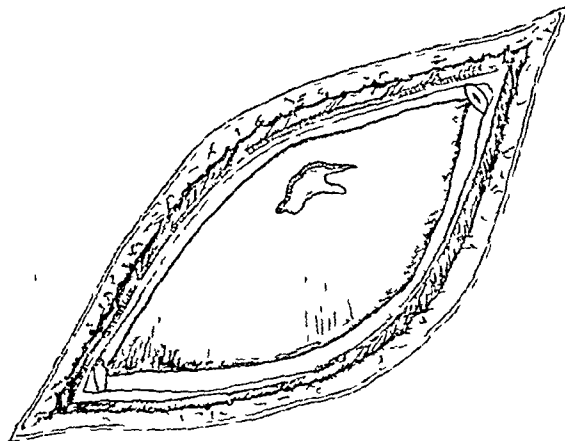
FIG 100 —Laceration of wound of chest wall and fractured rib, exposing wound of diaphragm

1 If there is a wound of the lower part of the thoracic wall, it is excised with the injured muscle, bone, and pleura in one piece, and enlarged sufficiently to give access to the path of the missile (*Fig* 100)

2 Any lesion of the lung is then dealt with, pieces of metal, cloth, and bone being removed, and the contaminated portion of lung is best excised and sutured

3 The pleura is then cleared of blood and clot—in slight cases by swabbing, in severe ones by eusol, run in through a tube and siphoned off   Swabbing has advantages, but causes a great deal of shock, if prolonged

4 The pleura having been made as dry as possible, the wound of the diaphragm is excised and an incision about five inches long is made through the muscle (*Fig* 101), its edges are then sutured to the parietal pleura and intercostal muscles all round the wound of the chest wall, so as to close the main pleural cavity completely (*Fig* 102)

The above stages should be carried out as rapidly as possible, to lessen the risks of pneumothorax

5 The abdominal viscera are then examined, and injuries are repaired By this exposure the spleen can be dealt with easily, the anterior surface of the stomach and the cardia are in view, and its posterior surface can be examined by tearing through the phrenicogastric omentum , the jejunum and colon can be delivered and examined, and the kidney is within reach , if there is any difficulty, the incision is carried downwards and forwards into the abdominal wall, dividing the costal margin if necessary
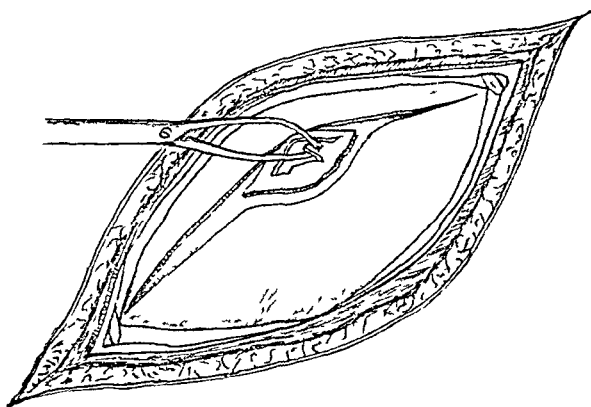
FIG 101 —Excision of wound of diaphragm

The wound is sutured in layers (*Fig* 103), drainage of the abdomen being established in certain cases It was my habit to drain the muscle layer with rubber tissue, and to insert the skin stitches at fairly wide intervals

Suturing the diaphragm to the chest wall has certain advantages over separate suture of diaphragm and parietes independently —(1) It ensures more secure closure of the pleural sac , (2) It allows the abdominal part of the operation to be done after the pleural cavity has been closed , (3) It permits of drainage of the peritoneum, and the muscles , (4) The costophrenic recess can be closed off from the main pleural sac, and drained, in certain cases

If it is ever thought advisable to drain the main pleural cavity, this should be done by a valvular method, permitting air and fluid to escape but preventing re entry

An operation such as I have described, modified to suit the needs of individual cases, provides good access to every part of the lung, and in this way I have dealt with wounds of the spleen, stomach, liver, colon, kidney, pancreas, and small intestine

TREATMENT OF SHOCK AND RESULTS OF HÆMORRHAGE

The Method of Anæsthesia — An operation such as this is a severe one for a recently wounded anæmic man, and every care must be taken to avoid additional shock , in this the method of anæsthesia

FIG 102 —Diaphragm sutured to the intercostal muscle closing pleural sac and exposing abdominal viscera

is the most important consideration Paravertebral novocain analgesia, with gas oxygen, is the method of choice , when gas was unavailable just sufficient chloroform was given to keep the patient in light sleep if there was a wound of the lung otherwise, a similar stage of anæsthesia was obtained with ether Paravertebral nerve blocking is quicker than local infiltration of the area of operation, and is more suitable when excision of a contused and lacerated wound is the first stage of the operation The

intercostal nerves were blocked with 1 per cent novocain, some two cubic centimetres being injected at the lower margin of each of the ribs selected, near its angle as many as ten nerves were blocked in some cases

I would take this opportunity of expressing my debt to Captain Langdale-Smith and Captain W Stott for their skilful administration of many difficult anæsthetics

Blood-transfusion was responsible for many recoveries and I was fortunate in being associated for some months with Mr Harrison, of the United States Medical Service, and his team of workers, who were available day and night for the special treatment of shock thanks to the kindness of Dr Crile The blood was given usually towards the end of the operation, this, I think, is less wasteful and perhaps more valuable than if it is carried out as a preliminary resuscitation measure, for one thing, a patient operated on before transfusion needs less anæsthetic
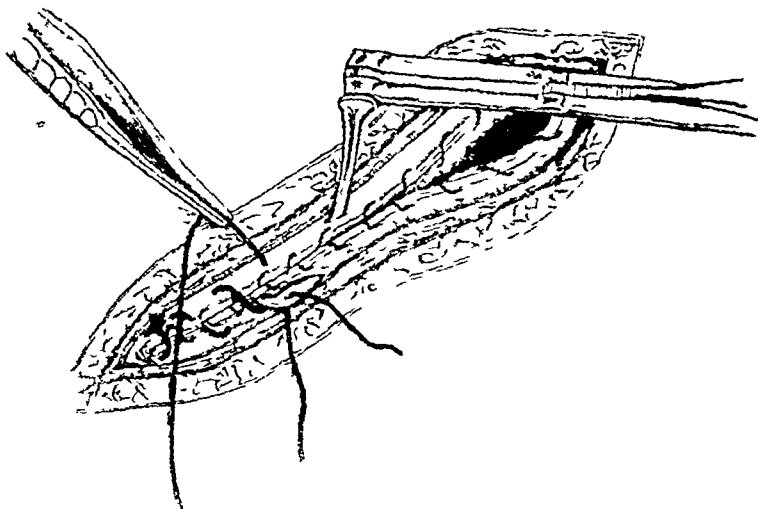
FIG 103 —Closure of the abdomen by suture of peritoneum and muscle

Oxygen was given during and for several hours after the operations—the only stimulant that is not valueless or harmful

Rectal and subcutaneous saline, up to twenty pints in twenty-four hours, was used as a routine, and for delayed 'abdominal shock' and distention, pituitrin was given

Varieties of Wounds of the Diaphragm —To make an elaborate classification of wounds of the diaphragm would serve no useful purpose, but one may consider the actual wounds of the various parts of the muscle, and the associated injuries of the different neighbouring structures

The following aspects may be borne in mind —

1 The part affected, whether the central tendon, the right or left vault, or the margin

2 The relation of the direction of the missile to the muscle parallel to its surface, causing injury by in-driven fragments of rib, or producing a gutter wound, oblique, perforating the muscle, missiles whose direction nearly corresponds to the long axis of the trunk

3 Complications of sepsis and hæmorrhage

4 Associated injury of liver, spleen, pancreas, kidney, stomach, colon, jejunum, omentum, or lung

5 Prolapse of abdominal viscera into the thorax

Illustrative Cases—It is proposed to give illustrations of the various types from the cases that came within my experience

Most wounds of the *central tendon* involve the heart, such cases very rarely reached the clearing station, and those I saw were moribund on arrival   Guthrie[6] gives notes and a sketch of a wound of this area, injuring the pericardium, heart, lung, and liver, the soldier, wounded at Waterloo, died of pneumonia the following November, having suffered since the wound from "palpitations and other uneasy sensations in the chest ' (*Fig* 104)
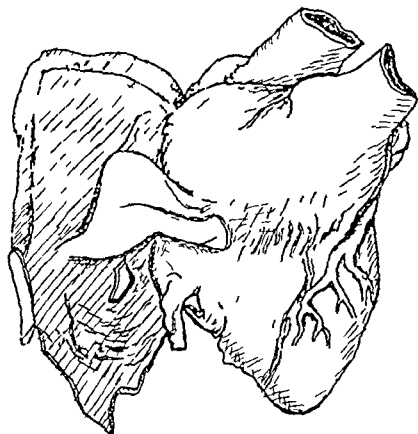
Fic 104 —Wound of the central tendon of diaphragm pericardium and left ventricle of heart (*after Guthrie*)

Contour wounds, more or less in the line of the margin of the thorax, may cause severe injury to the edge of the diaphragm without involvement of the pleura   Wounds of this type, even when the peritoneum is uninjured repay early operation, for excision *en masse* of the wound and fractured cartilages and ribs, and suture of the diaphragm and parietes, prevent suppuration and the disability that results from a large mass of scar tissue in this situation

In wounds at a higher level, the missile might remain above the diaphragm, but a small perforation be caused by a fractured rib driven through the muscle

Case 31 —Wound of diaphragm and liver by fractured rib (*Fig* 105)

Gunner D J W, wounded by shell 9 30 a m, May 16, 1918   The missile passed through the right arm, dividing the brachial artery, and entered the chest in the mid axillary line, fracturing the 6th and 7th ribs

Operation, six hours later—Wounds of arm excised, artery ligatured   wound of thorax, with fractured part of ribs, excised, projectile removed from posterior part of pleural cavity, which was then cleansed and its upper part closed by suture of diaphragm to chest wall, hole in diaphragm, due to fractured end of 7th rib, sutured, liver wound not bleeding   Wound closed, with rubber tissue drain to costophrenic recess

Aseptic healing of wound of thorax   Evacuated to base on ninth day, with no chest symptoms

Similar wounds fracturing several of the lower ribs were frequently responsible for severe injury of the pleura, diaphragm, and underlying viscera by indriven bone, again the missile itself not penetrating   Wounds of this type were commonly seen on the right side, left-sided ones being more rapidly fatal

Case 26 —Contour wound causing indriven fractures of five ribs and severe laceration of diaphragm and liver with prolapse of omentum (*Fig* 106)

Pte A T, wounded by shell 11 a m, March 24, 1918, extensive open wound of right lower thorax, prolapsed omentum   On admission, ten hours later, pulse 72, poor volume

Fic 105 —*Case* 31   Wound of the diaphragm and liver by indriven rib

Operation at once—Excision of the large mass of damaged tissue with fractured parts of five ribs, and lacerated area of diaphragm   pleura cleansed and closed, lacerated liver resected and sutured, prolapsed omentum removed, liver packed, peritoneal cavity closed off by suture

The patient had been wounded in front of Arras on a day of the greatest anxiety *to* the British Army, he had to be sent to the base, in good condition, on the following day   I was unable to trace his subsequent history, but his chances were small

On the left side, wounds of this nature may cause injury of the stomach or spleen,[7] or allow the escape of abdominal viscera into the pleural cavity
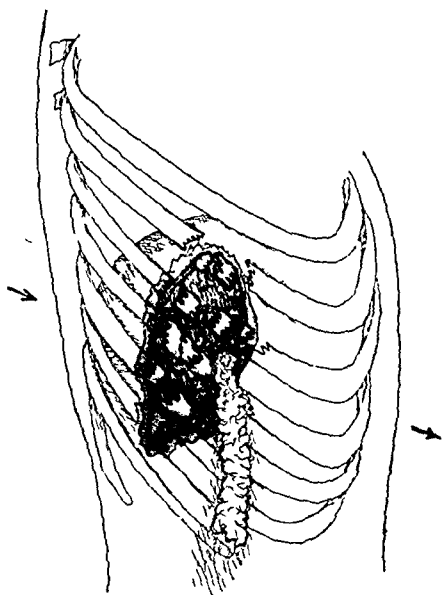
FIG 106 —*Case 26* Severe contour wound fracturing five ribs, with laceration of the diaphragm and liver
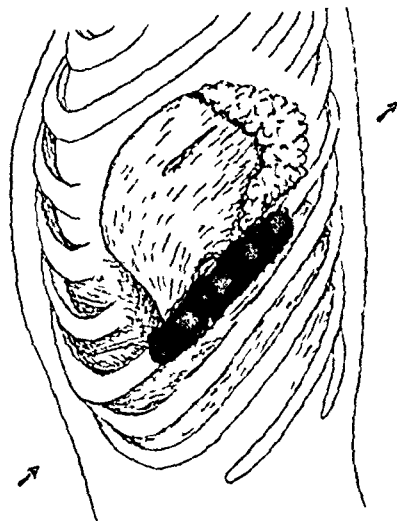
FIG 107 —*Case 16* Contour wound fracturing the eighth rib, prolapse of stomach and omentum through wound of diaphragm

Case 16 —Contour wound with immediate prolapse of stomach and omentum into pleural cavity (*Fig* 107)

Sapper A S , wounded by shell Dec 9, 1917, admitted same day with large 'sucking' wound fracturing 8th left rib , extreme dyspnœa, pulse 130

Operation —Wound and shattered rib excised , stomach and omentum, in which were embedded many rib fragments, prolapsed through large opening in diaphragm stomach reduced after suture of a laceration of its peritoneal coat, and omentum removed , inner margin of diaphragm opening sutured to intercostals, and wound closed with subcutaneous drain At close of operation, breathing and pulse were much improved

Third day, pulse 110, condition fairly good, but signs of extensive bronchitis in both lungs , death from bronchopneumonia on fourth day

The man was fat and forty, and this and the cold weather were unfavourable factors

The severity of some of these 'stove-in' wounds was frightful, but the outlook without operation was hopeless, and one hoped that occasional success might reward perseverance It was extraordinary that some of the cases reached the clearing station and survived operation even for a short time

Case 22 —Large wound of right thorax causing comminution of six ribs and severe laceration of diaphragm and liver (*Fig* 108)

Pte A G , wounded by rifle bullet 9 a m , Dec 29, 1917 Admitted 4 p m , extreme collapse, wound 3 in by 3 in , with blood, bile, and air escaping After 700 c c blood transfusion, slight improvement

FIG 108 —*Case 22* Large wound fracturing six ribs and lacerating the diaphragm and liver

Operation, at 5 p m —Wound excised *en masse* with several inches of six comminuted ribs , pleura closed after eusol irrigation Laceration of liver, 10 in long and 4 in deep, trimmed, cleaned, packed , wound partially sutured Death twenty four hours later

Missiles whose line is nearly parallel to the surface of the diaphragm may cause long cuts in the muscle, sometimes not dividing the peritoneum   This type of wound would allow the subsequent development of diaphragmatic hernia with a peritoneal sac

Case 1 —Gutter wound of diaphragm with missile retained in costophrenic recess (Fig 109)

Corpl J L K, wounded by shell Aug 11, 1917
On admission, lacerated wound related to ninth left rib, left abdomen rigid, left thorax immobile   X rays showed left diaphragm paralyzed, and projectile related to its posterior part

Operation —Wound and fractured rib excised, examination showed a wound of the diaphragm 2 in long by 1 in wide running from before backwards   Incision prolonged forwards and downwards, examination of under aspect of diaphragm showed its peritoneum intact   Returning to the pleural cavity, a piece of shell, ¾ in in diameter, and some cloth were removed from costophrenic recess   Diaphragm and parietes sutured, with subcutaneous rubber-tissue drain

Wound healed by first intention, the patient being sent to the base, quite fit, ten days later
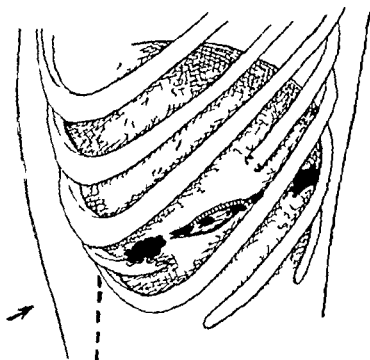
Fig 109 —*Case 1*   Gutter wound of the diaphragm without injury of peritoneum

On the right side, through and-through bullet wounds from the hypochondrium to the eighth, ninth, or tenth intercostal space usually do not need operation in the absence of bleeding which is unusual, the thoracic injury is limited to the costophrenic recess, and hæmothorax is dealt with by aspiration, which should be repeated frequently to minimize subsequent adhesions

If, however by a wound of this type a rib has been fractured, there is distinctly more risk of infection, which would spread from the comminuted fragments to the pleura   At the first possible opportunity, therefore, the wounded skin, muscle, pleura, and fractured

Fig 110 —*Case 12*   Through and through bullet wound of the diaphragm and liver causing subphrenic abscess

segment of rib are excised *en masse*, and primary suture is carried out, in many cases of this nature I closed the pleural sac by suturing the diaphragm to the chest wall

Through and-through wounds due to small fragments of shell were treated on the same lines, but infection of the pleura or liver, and subphrenic abscess, occurred more commonly than in bullet wounds of this region   The following cases illustrate these varieties of sepsis

Case 12 —Through and-through bullet wound of liver and pleura causing subphrenic abscess (Fig 110)

Pte C S, wounded Nov 30, 1917, entrance to right of lower dorsal spine, exit in right hypochondrium   Admitted in good condition, pulse 76, no sign of bleeding   Dec 7, symptoms and signs of subphrenic abscess

Operation — Healed posterior wound excised through intercostal space, pleura closed, wound of diaphragm reopened, and pus and old blood lying behind liver evacuated, drainage, a fractured transverse process was felt

After profuse discharge for some days, the condition cleared up, and the man was sent to the base, quite fit, Dec 14, there being only slight serous discharge, no thoracic complications

Case 14 —Through-and-through bullet wound exit sucking, followed by empyema and extraperitoneal subphrenic abscess (Fig 111)

Lieut A B L, wounded Dec 6, 1917, entrance at tenth right interspace, exit at twelfth rib, large and 'sucking'   On admission the following day, collapse and severe dyspnœa

Operation —Exit wound and fractured twelfth rib excised, pleura closed, track passing behind bare area of liver cleaned and drained with rubber tissue , peritoneum not opened

Dec 11, empyema aspirated, pneumococci identified , operation—pleura cleared of lymph and pus, valvular drainage , extraperitoneal abscess treated by two hourly instillation of brilliant green solution through Carrel tubes A subsequent operation for counter drainage of the empyema was performed, and the patient eventually recovered after a long illness with severe toxæmia

Shell wounds of the right side of the diaphragm are much more dangerous than those due to bullets, and primary operations for the arrest of hæmorrhage and the prevention of sepsis are frequently necessary Severe hæmorrhage from the liver was comparatively uncommon and was usually caused by large fragments of shell
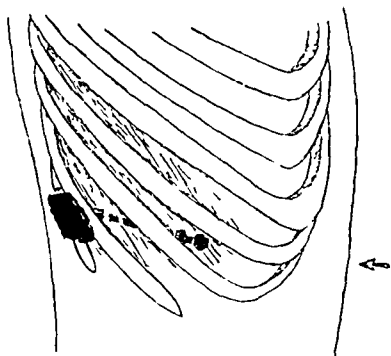
FIG 111 —*Case* 14 Through and through bullet wound of the diaphragm causing empyema and extra peritoneal subphrenic abscess
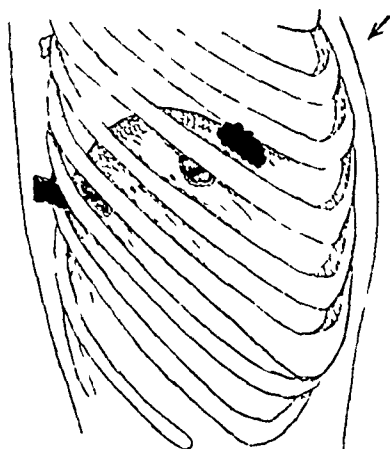
FIG 112 —*Case* 10 Severe wound of the diaphragm and liver, with open pneumothorax

Case 10 —**Large bleeding wound of liver with open pneumothorax** (*Fig* 112)

Pte A H R , wounded by bomb at 2 p m , Oct 31, 1917 , large wound 2 in outside right nipple, which, being 'sucking', was sutured at the field ambulance Large missile could be felt among muscles related to ninth intercostal space

Operation, 9 30 p m —Entrance of sixth interspace excised and enlarged , much blood and some fragments of liver lying free in pleural sac removed , large wound of diaphragm excised, and pleural cavity closed , detached pieces of liver removed from subphrenic space , large gutter wound of liver, bleeding (*Fig* 113) , liver wound cleaned, light gauze pack, suture of parietes Projectile and surrounding tissues excised, opening pleura at ninth interspace , sutured without drainage

Next day, temperature 105° Third day, temperature 102°, pulse 100, much bile and old blood discharging from drained wound Twelfth day, patient quite fit, temperature having been normal for some days , posterior wound healed without sepsis , anterior wound clean and closed by healthy granulation tissue Sent to base

A common variety of wound was where a small fragment of shell had passed through the lower part of the thorax into the liver, and was retained , at

FIG 113 —*Case* 10 Approximate representation of severe wound of the liver

first I thought these cases could be treated conservatively, but experience showed that cloth was often carried in and caused acute suppuration in the liver in some cases

Case 7 —Abscess of liver around two pieces of shell (*Fig* 114)
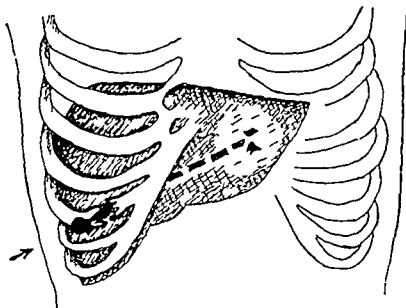
FIG 114 — Case 7 Abscess of the liver around two pieces of shell

Pte J F H, wounded Oct 26, 1917, missile fracturing anterior part of right eighth rib

Operation, the same day —Wound of chest wall and of diaphragm excised and sutured independently without drainage   Sixth day, wound healed, aseptic, fever, tenderness of liver X rays showed two foreign bodies in left lobe of liver   On the seventh day I was asked to operate on the man, who was intensely toxaemic

Second Operation —Exposure by the method of Auvray foul smelling subphrenic abscess opened, wound entering upper and outer aspect of the liver traced through long track to abscess, containing two pieces of shell, situated in posterior part of the left lobe, abscess drained, wound sutured   Death from toxaemia the next day

I have only on two occasions used the incision of Auvray [5] whereby a flap containing parts of the eighth, ninth, and tenth costal cartilages is turned inwards, and the diaphragm is incised below the pleural reflection line, the method gave a very good exposure of the upper surface of the liver but it appeared to me unduly destructive of nerves and productive of shock

As well as infection of the liver fragments of shell retained in this organ often caused infection of the pleura and the subphrenic space, while secondary haemorrhage into the pleura, and biliary fistula, were less frequent complications   Sir George Makins [8] has described the varieties of biliary fistula, in 7 out of 15 cases the fistula opened by way of the pleura, in one case fifteen pints of bile were removed by repeated aspirations

Experience of such complications convinced me that it was safer to remove by primary operation every fragment of shell bone, or cloth from this viscus   The operation is quick and simple   The thoracic wound is excised, the opening in the diaphragm is identified, and a cone of the muscle is pulled well out, so as to close off the pleural sac (*Fig* 115), the edges of the diaphragm wound are then excised, and the muscle is sutured to the intercostals the track in the liver is followed to the missile and is cleansed with Volkmann s
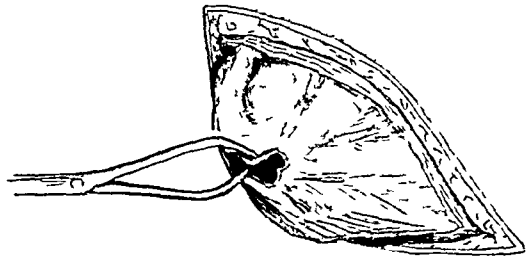
FIG 115 — Diaphragm pulled out of the wound to close pleural sac during excision of wound of diaphragm

spoon and gauze after the missile and all cloth have been extracted, the wound of the chest wall is closed, with a wick of gauze or rubber tissue in the liver track

Lockwood [9] advises that the liver wound be sutured and the diaphragm and chest wall be closed independently without drainage, but I think it is safer to drain the liver, and this is allowed by the method of suture of diaphragm to intercostals   A description of a typical case may be given —

Case 20 —Removal of shell fragment and cloth from liver (4 in deep) by trans thoracic operation (*Fig* 116)

Gnr W R, wounded 2 p m, Dec 22, 1917   lacerated wound of eighth right interspace in mid axillary line   On admission Dec 23, there were present dyspnœa with catch in inspiration, and frequent irritating, painful cough   x rays showed foreign body in liver

Operation, 6 p m —Wound excised, making opening 2 in long in pleura, wound of diaphragm excised after clearing pleura of blood by swabbing, pleura closed, track in liver explored with finger, and shell fragment and pieces of cloth removed, from 4 in deep, with spoon, track cleaned by swabbing, gauze wick inserted to position of missile, wound sutured

Drain removed on fifth day. Sutures removed on tenth day, aseptic healing, patient, quite fit sent to base

Severe primary hæmorrhage from the liver into the pleura is not uncommon

Case 24 —Severe intrapleural hæmorrhage from wound of liver due to small retained shell fragment

Pte J P , wounded Jan 26, 1918, by small missile passing through lower intercostal space posteriorly and retained in liver. On admission, pulse not palpable large hæmothorax, heart displaced to left. Severity of collapse precluded operation. Third day, condition improved, 10 oz blood aspirated from pleura, seventh day, three pints of bloody fluid aspirated. Feb 6, evacuated to base, quite fit
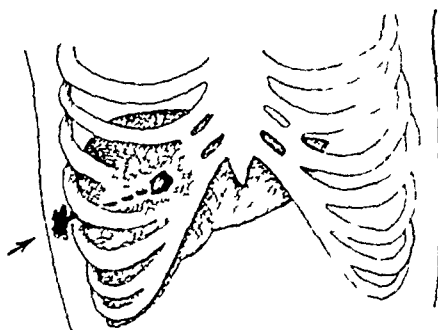
FIG 116 *Case 20* Fragment of shell retained in the liver

Secondary hæmorrhage was not so often seen

Case 21 —Infection of pleura by *B perfringens*, severe secondary hæmorrhage from wound of liver by small fragment of shell retained

Pte G A W , wounded 2 p m , Dec 27, 1917, in posterior part of tenth right interspace. On admission, severe collapse, rigidity and tenderness in hypochondrium , x rays showed small foreign body in liver, 6 in from skin

Operation, 10 30 p m —Wound excised, much blood removed from pleura, chest wall sutured

Jan 6, 1918, leaking of foul, bloody fluid from wound, *B perfringens* found , stitches removed, pleura drained. Jan 10, severe secondary hæmorrhage, filling pleura and escaping externally , ninth rib excised, pleura cleared of blood and closed by diaphragm-intercostal suture , light pack of bleeding liver track , 800 c c blood transfusion

The patient died of collapse and toxæmia

In this case a thorough primary operation might have been expected to give a better result

In all cases of wound of the liver, however slight the injury might appear there is risk of the development of a train of symptoms of extremely acute onset, followed by death in a few hours. A patient who is apparently doing well, with normal pulse and temperature, suddenly about the fourth day becomes intensely collapsed, and the pulse is not to be felt , there may be acute delirium, and the temperature runs up to 105° or more , death takes place in a few hours. In several cases the symptoms have been so acute that the nurses thought them due to severe hæmorrhage. Post-mortem examination showed no suppuration or hæmorrhage , on section the whole liver was pale except for a bile stained zone round the wound

The clinical condition of these cases closely resembled that seen in delayed anæsthetic poisoning, and appeared to be due rather to toxæmia from destruction of liver tissue than to infection , in several of the cases the wounds were quite slight, without laceration. I concluded that it is even more important to avoid the use of a toxic anæsthetic for patients with liver wounds than any other class

Injury of the lung by a missile which passes through the thorax before entering the abdomen is a serious complication, but needs no special consideration here , it suffices to say that any special treatment of the lung, as for arrest of hæmorrhage, should be completed before the abdominal part of the wound is dealt with

As to wounds of thorax and abdomen by separate missiles, there has been some difference of opinion among surgeons as to which should first be operated upon, thorax or abdomen. Sir Henry Gray[10] said the chest wound should come first , Gask and Wilkinson[11] advised first operating on the abdominal wound

Implication of both lungs in a wound which traverses the diaphragm usually causes death. In one case of this nature I had to operate for hæmorrhage

Case 32 —Wound of both lungs and left kidney (*Fig* 117)

Pte W B   Bullet wound at midnight, May 17, 1918 , entrance sixth right interspace, exit posterior aspect of left chest , severe hæmoptysis and hæmatemesis at once

Operation, within twelve hours, for severe bleeding from open posterior wound —Exit wound and four fractured ribs excised , lung adherent to pleura and bleeding freely sutured   left kidney extensively lacerated, removed , diaphragm and chest wall sutured   *The patient died the same day*
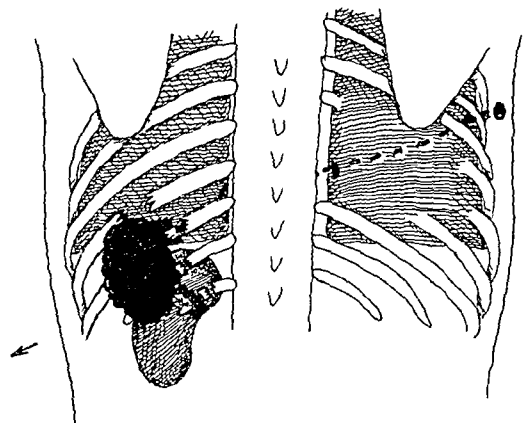
FIG 117 —*Case 32*   Through and through bullet wound of both lungs and the left kidney
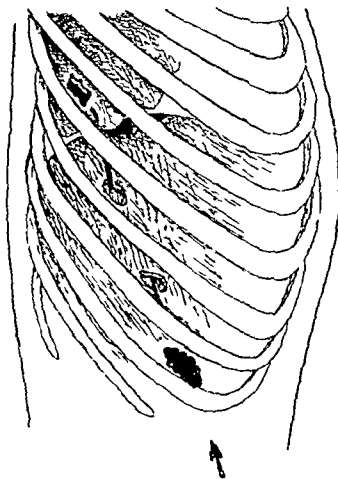
FIG 118 —*Case 9*   Double wound of the diaphragm muscle retained in lung

Wounds that traverse the diaphragm and then enter the lung are more serious as a rule than those passing from above downwards , of this class the most favourable are those that enter the lower part of the chest wall, pass through the diaphragm in two places, and then enter the lung

The following case died of acute infection, the inflammation of the chest wall being apparent when the patient reached the casualty clearing station

Case 9 —Fragment of shell retained in lung after perforating diaphragm in two places without injury to liver   removal of missile followed by gas gangrene of lung (*Fig* 118)

Lieut C H H , wounded 10 p m , Oct 30, 1917   Entrance right ninth interspace in anterior axillary line   On admission sixteen hours later, wound inflamed, large hæmothorax

Operation —Wound with œdematous muscle and 6 in of ninth rib excised , two holes in vault of diaphragm sutured , shell fragment removed from lower part of lung   lung wound cleaned and sutured , pleura cleared of clot, irrigated with eusol, closed without drainage

Next day, intense toxæmia, temperature 104° , stitches removed, foul fluid and gas evacuated , drainage   *B perfringens* identified   Death on fourth day

The passage of a projectile into the thorax, after traversing the intestine, nearly always caused death   I know of no case that recovered if the missile wounded the lung after passing through intestine

Wounds of the colon involving the pleura were specially difficult to deal with   the gut was usually loaded, and the danger of death from infection of pleura or retroperitoneal cellulitis was very great , to diminish the risk of the latter complication, so *common in* wounds of the ascending and descending colon, I adopted the expedient of *making* an oblique incision and leaving unsutured all the layers of the abdominal wall except the peritoneum   Such wounds do not gape if the patient is kept sitting up without intermission   Thanks to excellent nursing the patient whose case is next described recovered, in spite of the fact that the pleura, peritoneum, and perinephric fat had been severely contaminated with colon contents before admission

Case 34—Shell wound of right kidney, hepatic flexure of colon, diaphragm, and pleura, with fracture of rib (Fig 119)

Pte T H R wounded 10 20 a m, May 26, 1918 On admission, 5 p m Lacerated wound below right twelfth rib, missile felt at front part of sixth rib close to skin, which was punctured, and discoloured over wide area

Operation, immediately —Gas oxygen, novocain nerve block of intercostal and lumbar nerves Excision en masse of tissue round foreign body, with wide area of skin, fractured sixth rib, and wound of diaphragm, distinct fecal smell on opening pleura, and tissues excised were stained with intestinal contents, pleura closed, after irrigation with eusol, by diaphragm intercostal suture, wound closed without drainage Entrance wound excised and enlarged forwards and downwards to linea semilunaris, right kidney, torn right across, removed, considerable soiling of peritoneum from through and through wounds of hepatic flexure, colon wounds sutured, peritoneum closed, wound otherwise left open, except for two sutures to rectus sheath, Carrel tubes to abdominal wall and perinephric fat Blood transfusion 20 oz At end of operation, pulse 120, blood pressure 70

May 28 and 29, aspiration of small quantity of blood from chest June 1, fecal fistula June 3, Carrel treatment stopped June 10, fistula closed itself June 11, chest wound healed by first intention, abdominal wound granulated to level of skin, 1 in wide at widest part Patient sent to base Wrote from England a few weeks later, Wound almost completely healed, awaiting a ship for repatriation to New Zealand"

When the direction of a missile nearly corresponds to the long axis of the body, it may have a long course in abdomen and thorax before being arrested, in such a case, the problem that presents itself is how to obtain exposure of all the injured structures with the minimum of additional trauma to a patient already suffering from severe shock and haemorrhage To make separate abdominal and thoracic incisions increases the length of the anaesthetic and the number of manipulations, whereas resection of the eighth or ninth rib and incision of the diaphragm give sufficient exposure of the thorax and abdomen for most injuries, if necessary, the incision can be prolonged into the abdominal wall

The next case illustrates these points and is also of interest because it was the first occasion on which I performed a partial resection of the spleen, this appeared to me to be less severe than splenectomy for wounds not involving the hilum, but it would be hardly feasible by any other exposure Splenectomy for wounds has had a high mortality, and it is agreed that the removal of this organ diminishes resistance to infection I am not aware that partial resection has been previously carried out or advocated

FIG 119 —Case 34 Shell wound of the right kidney colon diaphragm, and pleura

Case 41—Wound of spleen diaphragm and lung, resection of damaged part of spleen Large projectile removed from upper lobe of lung (Fig 120)

Gnr W P R, wounded 1 p m, July 24, 1918 Large lacerated wound 6 in to left of third lumbar spine Six hours later, condition good, pulse 76, severe dyspnœa, left abdomen rigid, no vomiting or hæmoptysis X rays show missile in upper part of lung close to heart, and large hæmothorax

Operation, 8 30 p m —Pulse 84 Light sleep by chloroform on one layer of gauze, lower seven dorsal and upper three lumbar nerves blocked with novocain Anterior 6 in of eighth rib and costal cartilage removed, pleura opened and cleared of large quantity of blood, piece of shell, 1 by 1 by 2 in, embedded in upper lobe of lung, removed lung track cleansed by swabbing, lower lobe examined and found uninjured, missile having passed to its inner side, irrigation with eusol Wound at highest point of diaphragm sutured and fixed by same stitch to sixth interspace, pleura closed by diaphragm intercostal suture Incision near margin of diaphragm, spleen bleeding from

severe lacerations of its lower third extending right through it in in area 3 in wide (*Fig* 121)
resection of lower three fifths of spleen, suture of capsule controlling bleeding , abdominal viscera
carefully examined and found uninjured , bleeding omentum removed , wound closed, with rubber
tissue to spleen   Wound of entry, passing up through abdominal wall to outer side of colon,
excised in one piece, peritoneum sutured, rest of
wound packed with 1 per cent iodoform paraffin
gauze   Pulse 92 at end of operation

Next day, pulse 92, no dyspnœa, vomited twice
slightly , third day very fit, pulse 88, temperature
remains normal , fourth day, drain removed, no in
flammation of loin wound , sixth day, 15 oz aspirated
from pleura , seventh day, stitches removed, upper
wound healed, loin wound appears aseptic , nineteenth
day, sent to base, loin almost healed

Went to England a few days later, and returned
to his home two months afterwards, without com
plications
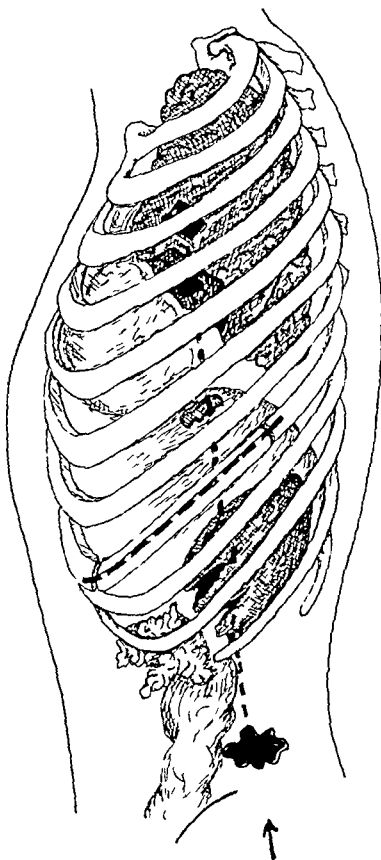
Fig 120 —*Case* 11   Wound of the spleen
diaphragm omentum and lung

Fig 121 —*Case* 11   Extent of injuries of spleen treated
by resection of three fifths of the viscus

For anatomical reasons, wounds which perforate the left side of the diaphragm offer
more variety than those on the right, and are often responsible for special complications
requiring surgical intervention , the more important of these are hæmorrhage from the
spleen, mesentery, or omentum, penetration of stomach or intestine, and escape of
abdominal contents into the pleural sac or even outside the body   A wound of this side
also causes more respiratory and cardiac embarrassment, from the communication
between pleura and peritoneum, prevented on the right side by the liver

Wounding of the spleen is not necessarily an indication for operation, for small
missiles frequently pass through it without appreciable bleeding, and superficial glancing
wounds sometimes bleed little , more commonly, however, the organ is extensively
lacerated, and as a general rule it is safer to look and see than to wait and see

A case of splenic hæmorrhage that had to be treated conservatively was the
following —

Case 23 —Severe splenic hæmorrhage associated with destruction of left arm

Pte H W   wounded by shell, Jan 19, 1918   Admitted in extreme collapse pulseless   left
arm destroyed at level of surgical neck of humerus, attached by two bridges of skin only   missile

h id struck lower ribs, ind signs of splenic hemorrhige were present   h id suffered from dirrha i for some days previously

Operation —G is oxygen , rapid imputation of irm through tuberosities of humerus

Next day, flicker of pulse uncount ible, ibdomen tender ind distended, vomiting and absolute constipation   Third d iy pulse 140, continuous vomiting, complete obstruction, ibdo men rigid, dullness of fl inks

Second Operation —Spinal in esthesii by novocain, small incision outer p irt of right rectus sheath , clot ind several pints of fluid blood evacuited, rubber tissue dram of pelvis   Patient it end of short operation pulseless 600 c c blood transfusion, pulse immedi itely afterwards 110

Recovered without incident   Sent to base on fifteenth d iy , irm healed by first intention, short sinus of abdomin il w ill

The common varieties of wounds of the spleen were gutter wounds of the outer surface, through and through perforations with radiating splits of the capsule (*Fig* 122) severe lacerations, and complete separation of a segment

I IG 122 —Double wound of the diaphr i,m and spleen
(*Specimen 356 War Collection Museum of the Royal College of Surgeons of England*)

In my cirlier cases I sutured the wounds or removed the organ , when I realized the c ise with which the spleen could be exposed by an incision through the outer part of the diiphragm, I was able to resect the damaged portion in some cases

In m iny cases wounds of the spleen are associated with injuries of other visceia , in the following case the spleen alone was injured

Case 46 —**Wound of diaphragm and spleen , transthoracic splenectomy** (*Fig* 123)

H M , German, wounded by bullet, Aug 8, 1918   Admitted s ime d iy   Se iled entr ince in left loin exit seventh interspace, prol ipsed omentum, blood escaping , pulse 90, blood pressure 110

Operation —Omentum removed , excision of wound and 3 in of eighth rib and cartilage wound of diaphr igm excised , pleur i closed , lower two thirds of spleen lacer ited into hilum ,

splenectomy, closed without drain 96 There was no sign of shock

Gas oxygen and novocain were employed, pulse at end being 96 Pulse next day 96 Seventh day, little blood aspirated from pleura, wound healed, aseptic Eighth day, evacuated to base, quite fit

In the next case the missile pulped the spleen and was retained in the pancreas
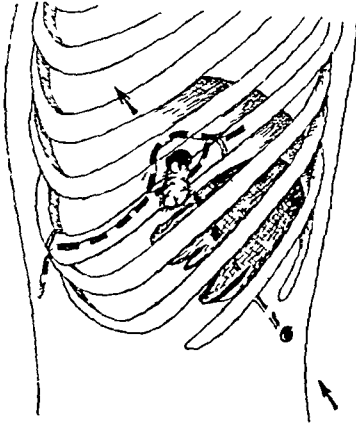
Fig 1.3 —Case 46 Wound of the spleen and diaphragm with prolapse of omentum
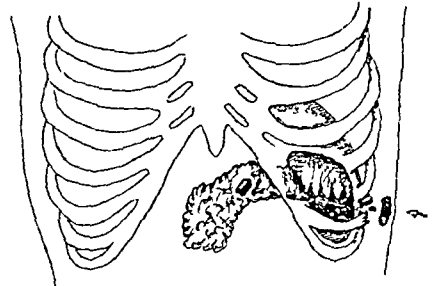
Fig 1.4 —Case 35 Shell wound of the diaphragm spleen and pancreas

Case 35 —Shell wound of diaphragm, spleen and pancreas (Fig 124)

Sergt J H, wounded 9 am by shell fragment, May 31, 1918, fracturing ninth left rib in posterior axillary line, vomited at once On admission, collapse, pulse 130, general abdominal rigidity X rays show missile 1½ in from mid line, 6 in deep from front, at level of wound

Operation, seven hours after injury —Wound and rib (3 in) removed, omentum prolapsed in pleura reduced wound of diaphragm excised, pleura closed, pulped spleen removed, track traced into pancreas, missile not removed, closed without drain after exploration of viscera and removal of much blood from abdomen Blood transfusion 25 oz

Except for one aspiration of the pleura, the patient recovered without incident, and was sent to the base about three weeks later

In several cases severe hæmorrhage from omentum was a complication of a wound of the left side of the diaphragm, the viscera escaping injury (*Cases* 13, 43)

The stomach is often implicated in abdominothoracic wounds, it may be perforated it may prolapse into the thorax, and in one case a gastric fistula discharged through a wound of the lung It is often the cardiac end of the viscus that is wounded, and this region and the posterior surface are more accessible through a thoracic than an abdominal incision

The following case illustrates the ease with which a lacerated wound 1 in from the cardia was sutured, and the posterior surface explored, by tearing through the gastrosplenic omentum The missile had remained in the lumen of the stomach
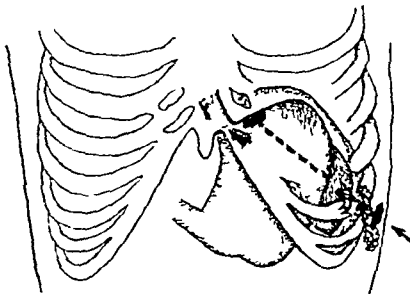
Fig 125 —Case 37 Shell wound of the diaphragm spleen, and stomach with prolapsed omentum

Case 37 —Abdominothoracic wound of spleen and stomach with prolapse of omentum (Fig 125)

Sergt L A P, wounded 11 pm, June 2, 1918, fragment of shell entering seventh interspace in mid axillary line, no vomiting Admitted seven hours later Pulse 108 left abdominal rigidity catch in respiration, x rays showed missile related to left suprarenal body

Operation, eight hours after injury —Gas oxygen intercostal nerve block, excision of wound and fractured eighth rib and cartilage (6 in) prolapsed omentum reduced, diaphragm wound excised pleura cleansed and closed Incision prolonged to abdominal wall lacerated wound of greater curvature of stomach 1 in from cardia sutured through and through wound of spleen not bleeding, closed without drainage after careful examination of whole of posterior surface of stomach

No shock or vomiting, small hæmothorax aspirated on fourth day Tenth day, stitches removed, healed except for one stitch abscess of abdominal wall Sent to base on thirteenth day Wrote from England in August ' Fully recovered, no complications

Injury of the kidneys was a common complication, its seriousness depending on hæmorrhage, and later perinephric infection, the former was usually controlled by packing, occasionally by suture, in many cases lumbar or transpleural nephrectomy was necessary. These cases call for no special description. For all wounds of the kidney it is essential to drain the perinephric tissue early, when a wound of the diaphragm is also present, it is important to close it, for in many cases an opening in this muscle allowed infection to spread to the pleura.

The effects due to the actual opening in the diaphragm have already been indicated, the one most worthy of special notice is the immediate prolapse of abdominal contents into one or other pleural sac. On the right side, this complication is unusual, but portions of liver may be found lying free in this side of the thoracic cavity, and occasionally omentum prolapses.

On the left side the omentum very frequently passes through the wound of the diaphragm, and this fact forms a definite indication that all wounds of the left side of the diaphragm should be repaired by operation if the risk of late dangerous complications is to be avoided. I have already described a case of hernia of the stomach immediately after a wound of the diaphragm. The occurrence of gastric or intestinal fistula opening through the thorax is uncommon, Gaudier and Labbe[12] recorded a case of fæcal fistula of this nature which developed some six months after a wound, and in a case operated upon by Chenier[13] there was a fistula of the splenic flexure opening through the thoracic scar. A wound complicated by gastric fistula came under my observation at a period when the surgery of chest wounds had been little developed.

Case 51.—Diaphragmatic hernia of stomach, with fistula opening through lung and wound of chest wall

Pte S E W, admitted April 4, 1917, with leaking wound of posterior part of intercostal space of left side, vomiting and severe collapse. The general condition improved, but on the fifth day escape of gastric juice was apparent, and the condition began to deteriorate. On the seventh day I made a jejunostomy under local analgesia, but the man died on the following day.

Autopsy.—The whole of the stomach was in the left pleural sac, a wound of its posterior wall communicating with the exterior by track passing through left lung, which was adherent to stomach and parietal pleura, no sign of infection of general pleural cavity or of peritoneum.

LATE EFFECTS OF INJURIES OF THE DIAPHRAGM

Most of the late effects which follow rupture and wounding of the diaphragm fall into three groups. (1) *The results of a foreign body embedded in the muscle*, (2) *Scarring and adhesions*, (3) *Diaphragmatic hernia*

1 **Foreign Bodies Embedded in the Muscle.**—In 1917, Patel[14] reported a series of cases in which he had removed foreign bodies from the diaphragm. Of 64 missiles retained in the thorax, 25 were embedded in the diaphragm, all these were successfully removed by an extrapleural route.

SYMPTOMS.—The most prominent symptom produced by a projectile embedded in the diaphragm is fixed pain, which is exaggerated on exertion, and is sometimes referred to the clavicle or scapula, it is produced especially by the effort of lifting, by coughing, and by deep respiration. Some patients complain of attacks of suffocation, due presumably to the foreign body being in contact with one of the phrenic nerves, in others an irritating cough is brought on by every deep respiration. The patient learns to keep the diaphragm immobile on the affected side, and as a rule this provides the only physical sign.

DIAGNOSIS.—This depends on localization by x rays. The depth of the missile is measured, and the fact of its being embedded in the muscle is shown by the extent and direction of its movements during respiration, if in the anterior portion near the parietes, the direction of movement is that of the thoracic wall and the converse of the movement of the diaphragm, if the foreign body is in the anterolateral part of the muscle, it is displaced vertically on respiration as well as moving in a lateral and anteroposterior

direction , if it is attached to the central tendon, it undergoes wide vertical excursions, and the movements of the heart are transmitted to it , while in missiles situated posteriorly no movement takes place

TREATMENT.—In removing missiles from the front part, Patel made an incision close to the xiphoid cartilage , to approach the anterolateral region a subcostal incision was made, resecting a costal cartilage and stripping back the pleura after dividing the triangularis sterni, if met with , for missiles embedded posteriorly, either the lateral route was used, or an incision was made near the spine, the twelfth rib being sometimes resected   By the extrapleural route one foreign body, 14 cm deep, embedded in the central tendon close to the right wall of the pericardium, was removed through an incision close to the lower part of the sternum, a triangle of costal cartilage being resected

Phocas[15] described, in 1917, a case of removal by the transpleural route of a fragment of shell embedded in the diaphragm near its highest part on the left side , and of the 49 retained projectiles whose removal from the chest Sir Berkeley Moynihan described to this College last year,[16] one was embedded in the diaphragm and removed through the pleural sac

Since we have had so much experience of open transpleural operations, this method seems to possess no particular dangers, and it allows the release of pleural adhesions which are often responsible for some of the symptoms

2   Scarring and Adhesions.—Adhesion of a scar of the diaphragm to the chest wall, and to the viscera in relation to it above and below, appears to cause a definite disability , I have had the opportunity of seeing several men who had been wounded years previously by missiles traversing the muscle   Objective signs were slight, but the train of symptoms was very similar in all cases, and it appears that involvement of the diaphragm in a scar is a considerable handicap to a working man

SYMPTOMS.—There is pain on exertion, situated in the region of the wound, the lower part of the thorax and the upper part of the abdomen on the injured side, and just below the clavicle   Pain below the clavicle is specially severe when the abdominal muscles are fixed in lifting weights   In some cases there is precordial pain and palpitation, due presumably to extrapericardial adhesions of the left costophrenic sulcus

An instance of these symptoms is the case of W B , who was wounded on March 2, 1918, by a bullet which passed through the right side of the diaphragm horizontally from front to back   In August, 1920, he was complaining of severe pain in the lower part of the right chest, the right hypochondrium, and below the clavicle, brought on by fast walking or running, by any exertion which involved forcible contraction of the abdominal wall   and by drinking large quantities of fluid   The lower lobe of the lung had evidently been collapsed and had failed to re expand completely , the symptoms appeared to be due to adhesion of the diaphragm to the liver and to the parietal pleura

McDougall[17] investigated the late results of chest wounds in a large number of cases, and he agrees with other observers as to the definite disability resulting from intrathoracic adhesions, particularly those passing from diaphragm to chest wall   Grey Turner observed that patients suffer more from pain and tenderness when there is a localized area of adhesions than when there is general diffuse adhesion of the pleural surfaces, and Moynihan s[16] experience confirms this

Many soldiers have complained of gastric symptoms subsequent to a wound of the chest, especially loss of appetite, and vomiting   These symptoms may be due to immobility of the diaphragm, adhesions passing from it to abdominal viscera, and sometimes to a communication between pleural and peritoneal cavities

DIAGNOSIS.—The presence of adhesions involving the diaphragm can be demonstrated by x rays, typical appearances being alteration of its regular contour, absence or limitation of movements, and obliteration of the costophrenic sulcus

Undoubtedly diaphragmatic hernia is a more common sequela of wounds of the left side than has been realized, and many cases have been overlooked   There is danger of diagnosing adhesions alone in patients whose symptoms are really due to hernia, and this condition should always be suspected in men complaining of pain and attacks of vomiting if there is a possibility of the left side of the diaphragm having been wounded

I saw recently a pensioner, H B , who was wounded in the left thigh by a rifle bullet on August 14, 1915   There were two scars below the left iliac crest , the lower one was circular , the other, immediately above it, was vertical and about 2 in long   The wound had always been considered to be a superficial one of the through-and-through type   There was no sign of bone or muscle injury, but the man was complaining of pain in the chest, cough and expectoration palpitation on exertion, and shooting pain under the heart , he was thin, pale, and cachectic, with a pulse rate when resting of 120   Rhonchi were heard in the lower part of the left lung   I suggested an x ray examination, and this showed a bullet in the left chest, just above and outside the apex of the heart

The military history of this man is interesting, for he was sent back to duty overseas six weeks after being wounded, and he remained with the army abroad until April, 1919   he succeeded in gaining admission to hospital for two months in 1917, and for two and a half months in 1918, the diagnosis of bronchitis having been made on the first occasion, and pyrexia N Y D on the second occasion   I saw him because he was appealing against an inadequate pension

I have mentioned this case because the significance of wounds of this type is apt to be overlooked

TREATMENT —As to the treatment of pleural adhesions involving the diaphragm, their separation during operations undertaken primarily for the removal of foreign bodies has seemed to play an important part in the relief given to the patients   but it is a question if thoracotomy is a justifiable operation for adhesions alone, especially as the most difficult position from which to clear them is the costodiaphragmatic sulcus The operation itself is not dangerous, but it is difficult to ensure a perfectly dry pleura at the end, and in some of the recorded cases empyema has followed, causing fresh adhesions

MacMahon[18] has recommended a deep breathing exercise to get rid of adhesions between diaphragm and chest wall, the patient lying supine and the operator pulling strongly on the fully abducted arms at each inspiration , but it is difficult to believe that exercises can do much, except perhaps in quite early stages

Another late complication of an abdominothoracic wound is due to infection of the lung or of an abdominal viscus in which a missile is retained   Dr Willy Meyer[19] gives details of a case of abscess of the liver around a bullet which had entered through the thorax six weeks before , he operated successfully through an incision of the eighth intercostal space   Many of the cases recorded by Moynihan had a focus of infection of the lung around the projectiles which he removed several months after the receipt of the wounds

3 Diaphragmatic Hernia Resulting from Injury —By far the most important of the late results of wounds and other injuries of the diaphragm is due to the persistence of a communication between the pleural and peritoneal cavities, or to the stretching or rupture of a scar of the muscle   I have already mentioned that it was known very many years ago that wounds of the diaphragm rarely heal, and it seems likely that as a result of the recent international and civil wars there are now living a larger number of men suffering from diaphragmatic hernia than at any previous time

The experience of recent years has clearly shown that in some instances, at any rate wounds of the diaphragm do heal spontaneously, for well-healed scars have been seen at subsequent operations , in Mever's[19] case the wound of the right side of the muscle had healed and Greig[o] saw the healed scar of a wound of the central tendon some years after it had been inflicted   The truth seems to be that small wounds, especially if due to bullets and incised wounds, particularly those of the right side or the central tendon, do heal with a sound scar , on the left side, small wounds sometimes heal, but usually they are closed by the adhesion of stomach, spleen, or omentum   Large wounds of the right side are closed by the liver, to which their edges may become adherent , large wounds of the left side remain open—a source of great danger

TIME OF ONSET —Prolapse of abdominal viscera sometimes takes place within a few hours of the diaphragm being ruptured or wounded, but it is much more common for the onset of symptoms of diaphragmatic hernia to be delayed for several months   There has been considerable discussion on the question of how long after the injury the hernia

usually occurs, and in most of the recorded cases the early symptoms have been so insidious that it has been impossible to put a date to their commencement, when we consider the various anatomical and pathological factors, it is clear that the interval between the injury and the onset of hernia must vary widely in different cases

Sometimes the first symptoms have followed a sudden strain or prolonged effort In a case recorded by Ware,[21] the patient stated that he vomited everything for the first fifteen days after the receipt of an abdominothoracic wound, and from the same date suffered from severe constipation, in a case of Dr Soresi,[22] on the day following a wound the patient, after a severe fit of coughing, had a sensation of choking by something pressing on the inside of the chest and abdomen, and he then vomited food taken thirty eight hours before   Barton[23] described a case where, about five months after being wounded, the man who had been sent back to France, vomited every day after his first long march, and continued to do so for nine months, in other cases the symptoms have dated from a sudden effort, particularly lifting a heavy weight   Gaudier[24] considered that, in cases of insidious onset, prolapse of omentum preceded the colon and stomach

PATHOLOGY —It is said that diaphragmatic hernia may result from an opening caused by empyema or subphrenic abscess, but this variety appears to be extremely rare

The original injuries have been most commonly the result of bullet or shell wounds, but in some ardent races knife wounds of the diaphragm are not uncommon, Cornea[25] recorded 45 stab-wounds of the diaphragm, 7 of which were due to a stab of the fourth and fifth interspaces   Cases following simple rupture from run over injury are met with from time to time

Traumatic diaphragmatic hernia is very much more common on the left side, hernia of omentum into the right pleural sac sometimes occurs, but does not lead to serious consequences, very rarely hernia through the central tendon into the pericardium has happened   The commonest position for the hernial orifice is in front of and lateral to the oesophageal opening, sometimes continuous with it, sometimes separated from it by a band of atrophied muscle   In the very great majority of cases there is no true hernial sac, and the term prolapse would be more strictly correct, but a peritoneal sac is sometimes present, limiting the size of the protrusion   The edges of the opening may be sharp cut and fibrotic, or they may be unrecognizable, the muscle gradually thinning into a fibrous layer incorporated with the surface of the prolapsed viscera   The former is more common, as the result of a wound which has never healed, or of the giving way of a scar, the latter is probably due in some cases to the gradual stretching of a healed scar

The viscera most commonly prolapsed are the stomach, transverse colon and splenic flexure, the spleen, and the jejunum, in order of frequency, and the omentum is included in nearly every case, occasionally the duodenum, the pancreas, and the liver have been involved

The herniated viscera become adherent to the margin of the opening and to the thoracic contents   Adhesion to the pericardium and the parietal pleura is usual, adhesion to the lung is less common   These adhesions are often very firm, and constitute the most serious difficulty in treatment   In some cases, however, the organs form no attachments even to the diaphragm

The stomach becomes dilated and hypertrophied, and in some cases, of which examples have been given by Warren[26] and by Gaudier and Labbe[2], the sharp edge of the opening has produced an ulcer of the stomach   The heart is displaced to the right, usually only to a slight extent, the lung is collapsed and compressed, and occupies the upper part of the thorax   I have already mentioned examples of gastric and intestinal fistula complicating diaphragmatic hernia

Strangulation of the hernia is a frequent complication, and in many cases the condition has not been suspected until its discovery at an operation for acute obstruction Dr Ameuille[2] (mentioned by Gaudier and Labbe) had a case of intestinal obstruction due to the splenic flexure of the colon being alone strangulated in a diaphragmatic hernia

SYMPTOMATOLOGY —The cases can be divided into two main classes   (1) Those presenting symptoms of chronic diaphragmatic hernia, subject to recurrent exacerbations , (2) Cases suffering from acute obstruction and strangulation

1 *Chronic Type* —There probably exist a number of unrecognized cases in which a very small part of the stomach is herniated through the diaphragm as a result of an old wound   Soresi[20] has called attention to the probability that very small congenital herniæ are not uncommon   It is evident that if we can diagnose cases while the prolapse is comparatively small, the dangers and difficulties of cure by operation are much diminished

The symptoms of a small diaphragmatic hernia of the stomach and omentum are not very definite , but the occurrence of heartburn, loss of appetite, and pain after meals, palpitation, vomiting, dysphagia, dyspnœa, abdominal or thoracic pain on exertion, wasting and constipation, in a man whose scars indicate a possible injury of the left side of the diaphragm, should be viewed with grave suspicion, and he should be examined systematically with x rays, and kept under careful observation   The recorded cases of prolapse of a large portion of the stomach into the thorax have been sufficiently numerous to enable a fairly definite clinical picture to be described, and in many instances in recent years a definite diagnosis has been made before operation

It is interesting to read Guthrie's[6] descriptions of patients presenting chronic symptoms, and others with acute strangulation of diaphragmatic herniæ following wounds received at the time of Waterloo   For strangulation he suggested laparotomy, though he had not actually carried it out

The chronic cases fall into three classes   those in which abdominal symptoms predominate , those with marked respiratory distress , and those whose chief complaint is cardiac embarrassment   The majority belong to the first class   The symptoms vary with certain factors, depending on which viscera are prolapsed, how much of them is affected, their relation to thoracic contents, adhesions, and the nature, size, and position of the defect of the diaphragm

Abdominal symptoms —The implication of the stomach in nearly all cases is responsible for the most prominent symptoms   These may be almost entirely subjective, and one is impressed by the number of cases recorded in which the sufferers have been looked on as malingerers   The case described by Barton[23] is typical of many , here the soldier's complaints had been disregarded for months, and he was repeatedly sent back to duty, until he became extremely wasted and ill and was delivered into the hands of the surgeon

Pain is a prominent symptom , it may be situated in the epigastrium, the lower abdomen, the affected side of the chest—specially below the clavicle—or in the shoulder (a symptom first mentioned, I think, by Guthrie[6])   Præcordial pain is sometimes present   The pain comes especially very soon after any food or drink   and is in many cases so severe that the patients have taken nothing but a small milk diet for months   it is relieved by vomiting, and increased by exertion, especially weight-lifting   Occasionally it has been noted that the pain goes at night, when the patient lies down , sometimes it is relieved by lying on the left side (Rowlands[27]) or on the right side , in Sir Charters Symonds' case,[28] when, during acute exacerbations, the patient would sit upright with his back flexed, straightening of the back caused acute pain   There may be a sense of great distention after food, referred to the inside of the chest and abdomen and sometimes described as a feeling of acute suffocation

Vomiting is a most important symptom, and is increased by exercise , it occurs soon after meals, and to some extent relieves the pain and distention   Often the patients are unable to retain any solid food, but can take fluids , in Ware's[21] case cold fluid food could alone be retained, even warm drinks being vomited   The vomit may contain bile, and in some cases altered blood has been noted   A most valuable clinical observation in regard to the vomiting was described by Gaudier and Labbe[12]   the patient, who was extremely emaciated, could only retain fluids, and it was noticed that he did so much more easily when lying , by making practical use of this fact, keeping him recumbent before and after meals, his general condition improved and he was able successfully to

undergo a severe operation   It has since been recorded in several instances that vomiting and pain are prevented by avoidance of the upright position during and after meals, and this constitutes, perhaps, the most typical single symptom of diaphragmatic hernia Looking through notes published in the past, one sees it mentioned from time to time that symptoms abated at night, or were worse in the latter part of the day, but the application of these observations to treatment was not realized, in fact Guthrie[6] made the theoretical suggestion that in suspected cases the patients should be warned to remain erect for some time after each meal, and always to avoid stooping

In some cases there has been *dysphagia,* but this is commoner in the congenital variety of hernia

Constipation is almost invariable, and has often preceded other symptoms, with a liability to attacks of complete obstruction

As a result of the pain, vomiting, and constipation, most cases show *emaciation,* *anæmia,* and *cachexia,* and they are usually nervous   The wasting may be very gradual for patients learn to confine themselves to milk taken at frequent intervals

The respiratory symptoms are pain on deep breathing and dyspnœa on exertion Sometimes there are attacks of suffocation, especially in the evening

The cardiac symptoms are palpitation and precordial pain

There may be recurrent attacks of pyrexia

The objective evidence of the condition may be very slight, but most cases present some of the following signs —

Abnormal flattening or retraction of the abdomen, and on palpation a sense of emptiness of the epigastrium and left hypochondrium   The abdomen is is a rule relaxed, but sometimes there is localized rigidity and tenderness on deep pressure   The stomach resonance may extend to a level well above the nipple   The movements of the left side of the thorax are diminished, and fullness of this side of the chest may be obvious

Various abnormal chest signs have been noted by different observers   In the case described by J Grant Andrew [9] the base of the left lung was dull, the respiratory *murmur being absent in the lower half of the lung*   Not uncommonly the breath sounds are faint and accompanied by gurglings and borborygmi of amphoric note, these sounds are sometimes perceptible to the patient at each respiration, especially towards evening or after meals, splashing sounds can be elicited by moving the patient during auscultation of the epigastrium

Signs due to the close relation of the stomach to the pericardium are not very prominent, apart from a persistent tachycardia increased by exertion or meals   The heart is usually slightly displaced, as indicated by the position of its right border, the apex beat in most cases is in normal position, but diffuse, and the heart may present irregularities of rhythm   Tinkling sounds are sometimes produced by the impulse of the heart on the stomach, these may be perceptible to the patient, and may be heard by the surgeon on auscultation of the left chest

2 *Acute Obstruction and Strangulation* —This is a condition of great danger, and the recorded cases of recovery are not numerous, partly because of the pre-existing emaciation, but chiefly because owing to the difficulty of diagnosis of this rather rare condition, most of the cases have reached a desperate state of exhaustion before operation

In recording three cases, upon two of whom he operated, Mr Richard Warren[6] stated, in 1919, that of seven cases of diaphragmatic hernia admitted to the London Hospital, five were of the traumatic variety, five were admitted for acute obstruction and one recovered

The typical picture is one of acute obstruction with an empty abdomen   The patients are thin and very ill, with severe pain, continuous vomiting and absolute constipation, excessive thirst is often complained of   The abdomen is usually retracted and hollow without rigidity or tenderness, sometimes, however, there is tenderness, and in one of Warren s cases there was a resonant pear shaped epigastric tumour, which gave splashing sounds on palpation

In the chest there may be splashing on respiration, and tinkling corresponding with the heart-beats

DIAGNOSIS—In the chronic stage the cases have been most often mistaken for pyloric obstruction Confirmation of the diagnosis of diaphragmatic hernia is to be obtained by a-ray examination, but a glance at the literature of the subject shows that not infrequently the findings have been negative, even when a large part of the stomach was above the diaphragm These cases have been diagnosed as pneumothorax, and even the use of opaque emulsion has not led to a correct conclusion in all cases, it is clear that if the cardia and pylorus are in the abdomen the emulsion may be seen to pass below the diaphragm without entering a pouch of the fundus The x-ray appearances may closely resemble those of hour-glass stomach due to other causes, in one of the cases cured by Soresi,[22] at a previous operation a piece of shell had been extracted from the vicinity of the lesser omentum, and an omental band had been divided in the belief that it was producing the constriction

However in recent years the technique of the a-ray examination of these cases has been carefully studied, and many detailed descriptions of methods and results have been published [30] [31]

The comparison of the position of a single scar of entrance with the localization of a retained missile may give a clear indication of injury of the diaphragm Simple radiography may show an opaque area to the left of the heart shadow, irregularity of the diaphragm, and displacement of the heart to the right But it is from the use of radioscopy with the swallowing of bismuth or barium emulsion that the clearest evidence is obtained Repeated examination may be necessary, and in a small hernia of the stomach considerable manœuvring may be called for to get the emulsion into the thoracic pouch The patient is examined upright, facing the observer, and turned to both sides in turn, he is then screened in the supine, prone, and lateral positions, failing a positive result, he is placed in the Trendelenburg position, and again turned in the various directions Sometimes massage of the abdomen and deep respiration have been successful in bringing a small hernia to view, such pouches close to the œsophagus must not be mistaken for congenital œsophageal pouches
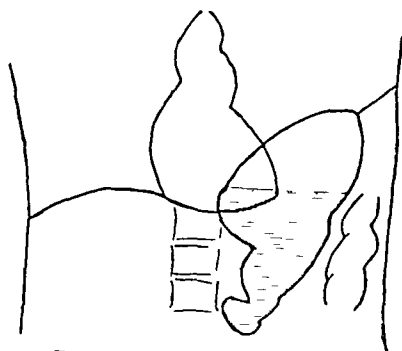
FIG 126 —Radioscopic appearance of a diaphragmatic hernia of the stomach after opaque meal (after Baumgartner and Herscher)
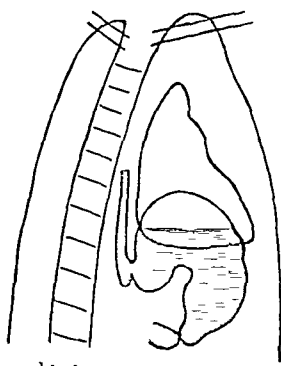
FIG 127 —Oblique radioscopic view of a diaphragmatic hernia of the stomach after opaque meal (after Baumgartner and Herscher)

The appearances seen on repeated examinations of two cases of Baumgartner and Herscher[32] serve as an illustration of the methods, the first diagram shows the condition seen after a barium meal, the patient upright and facing the observer, the stomach is above the level of the diaphragm, its lower part being occupied by emulsion, its upper part by air, above which the curved outline of the stomach is seen (Fig 126) The next view is an oblique one, showing two abdominal pouches and an intermediate thoracic one (Fig 127)
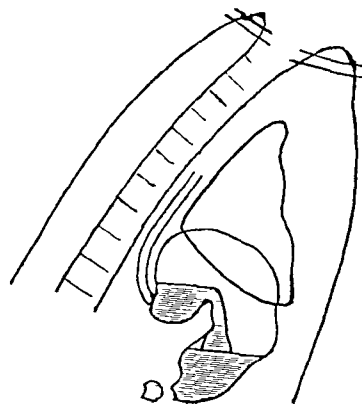
FIG 128 —Oblique radioscopic view of a diaphragmatic hernia of the stomach on the patient bending, the opaque emulsion is seen cascading from upper to lower pouch (after Baumgartner and Herscher)

At another examination in the

oblique position, sufficient opaque emulsion to fill the first pouch was given, on the patient bending forwards, the barium was seen to fall as a cascade into the lowest pouch (*Fig* 128)

In another case two pouches were shown, at each inspiration the barium flowed into the upper one, returning on expiration to the subdiaphragmatic part of the stomach Splashing of the surface of the fluid could be seen produced by the movements of the heart (*Fig* 129)

Radiographs published by Ware[21] show the appearances after an opaque meal with the patient upright and supine (*Figs* 130, 131) When the colon is involved, it may be made apparent to *x* rays by giving an opaque enema

PROGNOSIS —Strangulation eventually occurs in most cases, unless operation is undertaken Many successful operations have been performed in the quiescent stage, but Greig[20] has suggested that recurrence may be commoner than is supposed, so far there is little evidence bearing on this point, as most of the cases have been operated on in comparatively recent years

FIG 129 —Radioscopic view of a diaphragmatic hernia of the stomach (*after Baumgartner and Herscher*)

TREATMENT —Little can be done apart from operation, but in some cases the general condition of the patients, and especially the existence of chronic bronchitis in elderly men, has prohibited active surgery
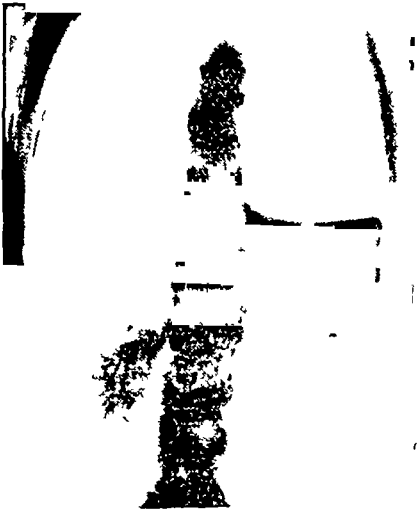
FIG 130 —Radiograph of diaphragmatic hernia of stomach patient upright (*after Ware*)
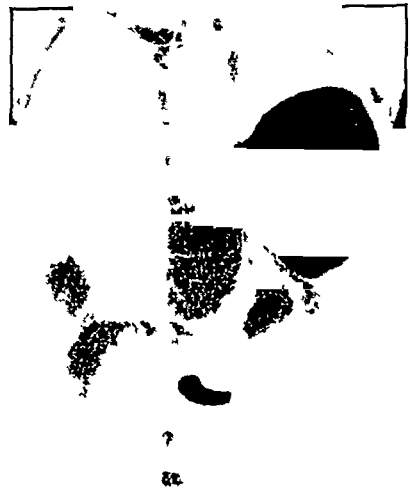
FIG 131 —Radiograph of diaphragmatic hernia of stomach patient supine (*after Ware*)

Such patients must be warned against exertion and sudden strains, their meals must be small, and they should lie down afterwards

The operative procedures fall into three groups —(1) The abdominal method, (2) The thoracic method, (3) The combined abdominothoracic method

1 The most commonly employed abdominal incision is one placed close to the costal margin, a manoeuvre which increases the exposure is to divide the costal margin A high left paramedian incision joining a transverse one at the level of the umbilicus, the left rectus being divided, gives a good exposure (*Fig* 132)

2 The thoracic route of approach has come into increasing favour since war has

provided surgeons with so much practice in chest surgery   A portion of the sixth, seventh, or eighth rib is resected , by removing all the rib in front of its angle a good view is obtained

3 The first description of the employment for diaphragmatic hernia of an incision opening abdomen and thorax together was apparently given by Berard [33]   The incision is made over the seventh, eighth, or ninth rib, and continued forwards and downwards in the abdominal wall , the rib is resected and the costal cartilage divided   I have used this method on many occasions for dealing with the results of abdominothoracic wounds, and it seems the most suitable for difficult cases of diaphragmatic hernia   Probably the best course is to commence by resec tion of the rib, prolonging the incision to the abdomen later if it proves necessary (*Fig 133*)
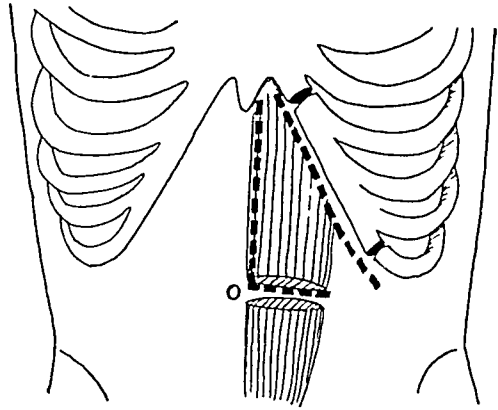
Methods less commonly used are to turn down a flap containing part of the eighth, ninth, and tenth costal cartilages (corresponding to the liver incision of Auvray), and a vertical incision in the mid axillary line, resecting several ribs   The objection to both these procedures is the extensive division of nerves and vessels that they necessitate

There has been a good deal of discussion of the relative merits of the abdominal and thoracic methods   The main objections to the thoracic route seem to be that surgeons are more practised in abdominal than in thoracic surgery, and that secondary conditions—for instance, gastric ulcer and adhesions—may necessitate intra-peritoneal procedures such as gastrojejunostomy

The abdominal incision will be used for most cases dealt with in the acute stage, for they come to surgeons as abdominal emergencies, and as a rule their exact nature is only discovered during the operations   The presence of a scar of the chest wall may have suggested the correct diagnosis, but the patient is usually unfit for systematic radioscopy   In most of these cases emaciation and complete obstruction, with empty intestines, make access to the diaphragm fairly easy from below

In a chronic case dealt with in a comparatively quiescent stage, however, the thoracic method, or the abdominothoracic one, offers considerable advantages , it allows a clear view with less retraction of the parietes, and the diaphragm can be repaired more adequately than by the abdominal route

Stages of Operation for Diaphragmatic Hernia — After opening the abdomen or thorax, the stomach, omentum, and other prolapsed viscera must be freed by dividing the adhesions , this must be done with the minimum of dragging, by clean cutting rather than blunt dissection   These adhesions, especially of hollow viscera to pericardium, and of spleen to thoracic wall, may be very dense, and care must be taken to divide them in such a way that, if important structures are injured, they shall be those most easily repaired , naturally it is better to open the stomach than the peri cardium or colon

Fig 132 —Abdominal incisions used in operations for diaphragmatic hernia
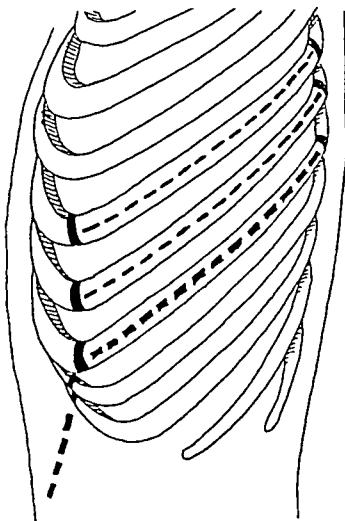
Fig 133 —Thoracic and abdomino thoracic incision for approach to a diaphragmatic hernia

The defect in the diaphragm may be very difficult to define, the whole of the left side of the muscle being atrophic and the margin of the opening incorporated with the stomach wall   In some cases of long standing, adhesions have been so dense, particularly of the stomach and spleen, that it has been considered unwise to attempt their separation In the case recorded by Baumgartner,[32] the diaphragm was reduced to narrow ledges in front and behind, the stomach was firmly adherent to the posterior margin of the opening, and the outer surface of the spleen was fixed to a scar of the thoracic wall, through an abdominothoracic incision the surgeon freed the small intestine, omentum, splenic flexure, and stomach from the pericardium and front part of the diaphragm, leaving intact the adhesions of the spleen and of the back of the stomach, he then adopted a manœuvre used previously by Lecene, closing the defect by suturing its edges
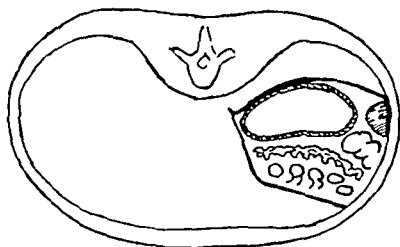
FIG 134 —Diagram of contents of a diaphragmatic hernia
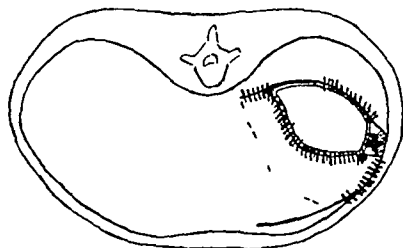
FIG 135 —Method of suture to close defect in the diaphragm (after Baumgartner and Herscher)

to the stomach and to scar tissue at the lower part of the spleen (*Figs* 134, 135), the result was very satisfactory, and radioscopy six months later showed the stomach below the diaphragm and the lung re-expanded (*Fig* 136)   In the successful case reported

FIG 136 — Radioscopic appearances ix months after cure of a diaphragmatic hernia (after Baumgartner and Herscher)

by Grant Andrew,[29] he found it necessary, operating through the abdomen, to divide the omentum and leave part of it attached within the thorax

A dangerous step of the operation is the reduction of the stomach into the abdomen, for its contents may be forced into the œsophagus and flood the only sound lung, this disaster was probably responsible for the death of a case operated upon by d'Hallopeau[34] and mentioned by Auvray Auvray recommends that the thoracic pouch of the stomach be emptied by aspiration before its reduction is attempted, a safeguard only possible if the thoracic exposure is employed

Careful closure of the gap in the diaphragm is important, and is more easily done from above   in most of the cases operated on from below for strangulation, the surgeon has had to make use of a simple purse string suture   A most thorough method of suturing has been described by Soresi,[22] who points out that the constant movement of the diaphragm during healing and the outward pull of its fibres, put a great strain on the suture-line   He advocates a series of separate stitches inserted parallel to the margin of the opening   the adjacent ends of each two sutures are then tied together, and the gap is closed by tying these ends across it   Greig[-0] stitched the inner edge of the opening to the chest wall, some of the stitches gave way during subsequent coughing, and a second operation was performed with eventual success   In repairing a defect of the outer part of the diaphragm Lefort[35] made successful use of a graft of fat and deep fascia taken from the thigh

The last stage of the operation is the closure of the abdomen and thorax, after paying careful attention to hæmostasis, if, in rare circumstances, it is thought advisable to drain the pleura, a valvular method which allows fluid and air to escape but prevents their re-entry should be employed

CONCLUSION —We may conclude then that in operations for strangulation and acute obstruction the abdominal route will be employed as a rule

In chronic cases, the thoracic method of approach has certain advantages   it allows thoracic adhesions to be divided under better observation, with more safety, and easier control of bleeding points , the herniated pouch of the stomach can be emptied before reduction , accurate suture of the diaphragm and any plastic measures that special conditions demand can be carried out more satisfactorily , and the pleural sac can be cleansed and its dryness at the end of the operation ensured

If special difficulties arise, or a gastrojejunostomy is indicated, the thoracic operation should be converted into an abdominothoracic one by prolonging the incision

In all types of operation the pleural cavity is open to the air, so that the slight risks of operative pneumothorax are equally present

I wish to express my thanks to Mr S A Sewell for the drawings of *Figs* 121, 122, 130, and 131 , to Professor J Ernest Frazer for help with some of the other diagrams , and to Mr Warren Low C B , for permission to use the notes of a case

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SKIN-GRAFTING IN THE BUCCAL CAVITY

By T P KILNER and T JACKSON, Sidcup

THE intention of this paper is to deal in full with one branch of technique which has been evolved at the Queen's Hospital, Sidcup, during the treatment of facial injuries in the last few years

In March, 1917, Esser described in the *Annals of Surgery* a method of skin grafting which he had employed in the treatment of distorted eye-sockets This method was modified and its field of usefulness greatly extended by Waldron and Gillies, and its various modifications have been in almost daily use for some time now by surgeons operating upon those cases of facial injury which have formed such a pitiable harvest of the Great War

Gillies' book, recently published, contains a brief description of the technique followed , but it is felt that a wider use of the method might be made than is at present the case by surgeons and dental surgeons who are unlikely to have that book in their possession

The paper will be divided into two parts (1) A brief outline of cases to which the method is applicable , and (2) A description of the technique

I CASES IN WHICH THE METHOD IS APPLICABLE

A —Cases in which the External Alveolar Sulcus is Absent, or Deficient in Depth

War Injuries —It is in this class of case that our experience has been greatest Numerous cases of facial injury involving the mouth, and frequently associated with fracture of the maxilla or mandible, have been encountered, in which the most trouble some residual disability is entirely dependent upon distortion or complete obliteration of the sulcus between the lip or cheek and the alveolus

Bulky masses or bands of scar tissue between the soft tissues and the bone render the fitting of an efficient functional denture impossible Such a disability is seen at its worst when the jaws are edentulous, for every movement of the cheek or lip displaces the denture from its already insecure bed

Parallel Cases met with in Civil Practice —In ordinary civil practice quite a large number of cases analogous to these war cases is encountered from time to time As our experience of these is extremely limited, we shall do little more than point them out

The similarity is, however, so close that their treatment by the same procedure cannot but give similarly satisfactory results

Excessive Absorption of the Alveolus —Cases of this type are particularly common in dental practice A recent visit, however, to the out-patient department of a general hospital revealed the fact that they are met with in surgical clinics also Two cases presented themselves in as many days complaining of ulceration of the gums and constant trouble with dentures, in which the source of trouble was easily traceable to the deficiency of the external sulcus, due in turn to unusually marked alveolar absorption No definite dental ridge remains in these cases numerous attempts are made to fit a denture, but neither comfort nor utility can be obtained , every movement of the jaw, tending still further to reduce the depth of any sulcus remaining, displaces the denture, and the patient is reduced to a state of desperation Such a condition is the bane alike of patient and dental surgeon

Fræna —Abnormally thick labial fræna are sufficiently common to find themselves illustrated in every book on dental surgery, as a cause, particularly, of central incisor displacements Similar mucous-membrane covered bands occur in other situations, and, though not as a rule interfering with dentition, and therefore not giving trouble in the first half of life, are very trying when the fitting of a denture is under consideration The ordinary treatment of these bands—division or even excision—is frequently followed by recurrence or by the formation of a soft papillary mass of scar tissue which renders such treatment ineffective Treatment by the method here advocated, though a little more troublesome, has all the advantages of being certain and radical in its results

Scar Tissue —Resulting from burns or scalds, or following ulceration produced by acids or caustics

Scar-tissue Bands —Following upon the rupture of an alveolar abscess in the region of the sulcus

Deficiency of the Sulcus above and in front as the Result of Hare-lip —Such a deficiency is almost always present in spite of every effort, at the time of original operation, to free the soft tissues well from the bone It would be impracticable, in such young subjects and under the conditions of tension already present, to introduce anything capable of preventing the recurrence of these adhesions, and their treatment is therefore usually not considered until dentures are required A great cosmetic improvement may be obtained by their treatment at an earlier date

B —Cases in which the Internal Alveolar Sulcus is Defective

War Injuries —It is remarkable how few even of the severest types of facial wound involve the tongue, yet quite a number of cases has been encountered in which wounds of that organ itself or of the adjacent floor of the mouth have led to the obliteration of the sulcus on the inner aspect of the alveolus In these cases even a carefully-fitted denture is constantly being pushed off the dental ridge by tongue movements during mastication or articulation

Parallel Cases in Civil Practice —Cases analogous to the above are few Occasionally, however, an unusually short and thick lingual frenum gives trouble in the manner indicated, more especially when the lower jaw is edentulous The rare cases of ordinary congenital tongue-tie are probably best treated by the simple operation of division at present practised

We hesitate to recommend the use of grafts in potentially cancerous areas, but throw it out as a suggestion that, in cases which have been successfully treated for carcinoma linguæ, or in which a portion of the tongue has been removed for less dangerous disease or for injury, articulation might be considerably improved by freeing of the remaining portion to some extent and epithelialization of the raw surfaces by the technique here described

C —Other Conditions in which the Method is Applicable

Trismus —This condition, depending upon the presence of scar tissue in the mucosa lining the cheek, has been met with occasionally in military practice, and might conceivably be found in cases coming under one of the above headings

In such cases, though the sulcus is not actually at fault, treatment follows the same lines, and consists essentially of the removal of all scar tissue and its replacement by sound healthy epithelium We have treated two cases in this way, and have obtained a measure of success much greater than we had anticipated In one of these, previous excision of the coronoid process, adhesions of which to the adjacent maxilla were thought to be responsible for the condition, had been carried out without giving any relief

After Removal of the Maxilla —The deformity which follows upon this operation can be rendered practically negligible if surgeon and dentist will combine forces As a rule, at the end of the operation there is not a very great extent of raw surface remaining but a mould designed in the way advocated for grafting and carrying grafts when neces-

sary, inserted at the end of the operation—preferably by the dentist who is to have the after-care of the case—not only prevents the deformity of the face which commonly follows the delay in instituting prosthetic treatment, but is also very efficient in preventing post operative hæmorrhage

After Tonsillectomy—It would appear that grafting of the raw surfaces shortens convalescence, diminishes post-operative hæmorrhage, and prevents cicatricial contraction　The pillars of the fauces are sewn together loosely over a skin graft covered mould of suitable size and shape

2　DESCRIPTION OF TECHNIQUE

The method consists essentially of　(a) Producing a sulcus wherever this is required by careful and free excision of offending tissue , (b) Epithelialization of this new sulcus by means of skin-grafts of the Thiersch variety applied to its surfaces upon a suitable mould　The operative treatment may be carried out under either local or general anæsthesia , but the latter, administered if practicable by the naso intratracheal route, is preferred　If, however, the former is chosen, the inferior dental or infra-orbital branch of the fifth is blocked, according as the sulcus under treatment is lower or upper , local infiltration of the actual area of operation is carried out , and the area from which the graft is to be removed is similarly treated The latter procedure does not interfere at all with the vitality of the graft, and actually facilitates its removal

Preliminary Dental Work—This consists in the provision of suitable means for retaining the mould in position, and differs according to the type of case

a External or Internal Sulcus Teeth present (Fig 137)—A metal cap splint is made, carrying opposite the centre of the offending area an upright pillar, on to which is fitted a small tubular piece of metal provided with a screw, and having a flat perforated malleable plate projecting from it at right angles, which is directed inwards or

Fig 137 —Dental splint for epithelial inlay to external alveolar sulcus

outwards in reference to the alveolus according as internal or external sulcus is under treatment　This plate is usually from $\frac{1}{2}$ to $\frac{3}{4}$ in in width, and its edges are neatly rounded When a gap in the teeth is present, as is usual in traumatic cases, a bar is placed between the caps fitted to those teeth bordering upon the gap and a vertical metal plate is attached to this and made to fit snugly against the gum-margin along the gap　This effectively prevents the mould material from escaping laterally and so helps much in obtaining a good, smooth and easily-removed mould

b Edentulous Cases—These cases are difficult to treat, and a considerable range of ingenious devices has been evolved in the dental department　Suture of the mould in position alone—a method tried in order to evade the necessity for fixation apparatus—is unsatisfactory, for even if successful as a
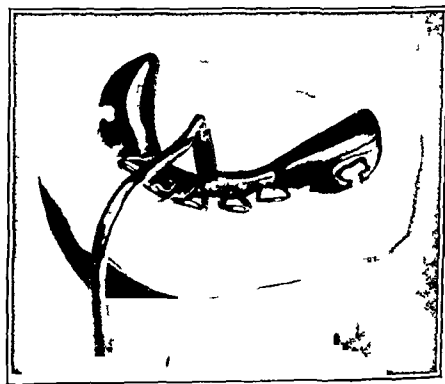
Fig 138 —Chin piece splint for lower sulcus in edentulous case

means of retention, it produces an unsightly and troublesome ridge around the margins of the grafted area   In addition it renders the after-treatment difficult, there being no

means of retention available once the sutures are out   The illustrations show the appliances now usually adopted for upper and lower alveolar regions   Fig 138 illustrates a chin-piece apparatus which has been found useful for some cases in which the lower sulcus was under treatment   Figs 139 and 140 represent an apparatus similar to Kingsley s splint, but provided with metal loops to carry the mould

Fig 1 9 —Modified King ley s splint for inlay to upper ulcus in edentulous case

Fig 140 —Splint in situ

material   Fig 141 shows a modified double Gunning splint which may be adapted for either the upper or lower sulcus
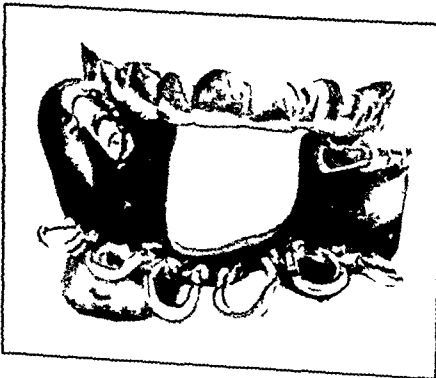
Fig 141 — Modified double Gunning splint which may be u ed for either sulcu   prepared for lower ulcus in case with edentulou mandible

c Trismus Cases —The type of apparatus (Fig 142) devised for these cases provides for adjustment to the maximum gape ob t un ble at the time of operation, and after excision of all scar tissue   It also carries a perforated metal plate, to the outer side of which is packed the mould material which is to bear the graft   The mould should be of sufficient size to produce bulging of the cheek   In this way an excess of epithelialized surface is obtained

Fig 142 —Type of apparatus used in trismus case

d After Excision of the Maxilla—In these cases the dental officer who is to have charge of the post-operative prosthetic treatment should be allowed access to the case for the purpose of obtaining an impression of those parts which are to be left behind on the unaffected side   He will then construct a partial upper plate carrying metal loops to support the mass of dental composition, which, at the end of the operation, is moulded into the large gap left by the maxillary excision
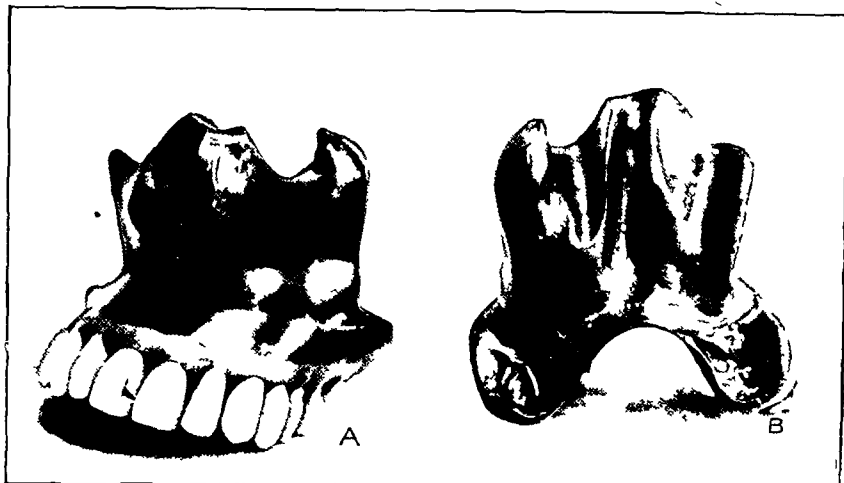
FIG 143 —Prosthesis built up to replace excised maxillae   A Anterior view   B Posterior view

Fig 143 shows a prosthesis built up, according to the suggestions put forward above, from a mould inserted at an operation undertaken for the removal of almost the whole of both maxillæ, which had been completely separated from their bony attachments as the result of a severe wound of the face   It is included because it indicates clearly how the same procedure may with advantage be adopted in civil cases

Preparation of the New Sulcus —In order to render the description of operation more concise, an outline of the procedure followed in dealing with a typical case of loss of lower sulcus will alone be considered It will be easily seen how this is modified for other positions *Fig* 144 shows the state of affairs encountered
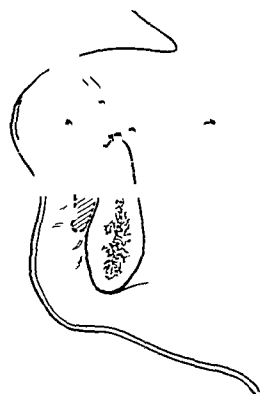
FIG 144 —Drawing to show total obliteration of lower sulcus Dotted lines indicate excision of scar tissue

The dotted lines indicate the incisions made for excision of the scar tissue   It is to be noted that the inner incision is made to follow accurately the surface of the bone   This is a point of great importance, for otherwise a spongy mass of tissue is left behind on that aspect of the alveolus which the operation aims at making free for the dentist's use   Such a mass is very troublesome and renders accurate impression taking impossible   Again, it will be noticed that the new sulcus is produced by *excision*   Mere incision into the scar tissue will when its sides are grafted, produce a sulcus, but such a sulcus invariably tends to become obliterated by the continued growth of scar tissue stimulated by operation   The tissue included within the dotted lines is completely removed, and any hemorrhage is arrested by sponge pressure   Ligatures are seldom required

Making of the Mould —An impression of the new sulcus is now made in ordinary dental-impression composition, rendered soft by sterile water at the required temperature The detachable portion of the retention apparatus is placed in position until the material

cools and hardens It is essential that a smooth, well-rounded impression should be obtained, and the lip or cheek should be manipulated with this end in view while the composition is setting

Cutting the Graft—The graft is taken from a non-hairy portion of the skin—the interior aspect of the forearm or the antero-internal aspect of the upper arm being usually employed   At one time the skin, sterilized by ether only and moistened with saline, was held on the stretch between two pieces of wood applied transversely to the limb, and the graft was cut by a sharp razor similarly moistened with saline This method of fixing the skin is clumsy, requires an assistant well versed in the technique, and owing to 'bellying' of the area between the pieces of wood, often results in a poor graft of uneven thickness

Lately we have been using the apparatus shown in *Fig* 145, and have found it simple and reliable The small teeth on the cross bars get a firm grip of the skin on either side of the area to be used, gentle pressure from above, pressing these bars apart, produces even stretching with a minimum of 'bellying',

Fig 145 —Skin fixation apparatus used in cutting grafts

and the ratchet locks the apparatus at the desired degree of tension

A mere touch on the upper part of the instrument with one hand steadies it, and the other hand is free for cutting We feel that some similar instrument should be of considerable help to surgeons who wish to render their graft-cutting more certain and uniform

Applying the Graft to the Mould—The mould, removed from the mouth, is dried, and the graft or grafts are applied to it so that the raw surface is outermost If several grafts are required they are arranged so that their adjacent margins just overlap one another The thinner the graft, the easier it is to manipulate at this stage, and the better in our opinion, is the final result Any redundant graft is removed by sharp scissors, for loose tags in the mouth become septic and are liable to be pulled upon by tongue movements and so displace the remainder The graft-covered mould is now returned to its bed and the fixation apparatus is finally adjusted *Fig* 146 shows a plaster model illustrating splint and mould in their final position

Fig 146 —Plaster model showing splint and mould in final position

After treatment—The arm is dressed with ambrine, and rapidly epithelializes again—never giving any trouble after the first dressing The mould is not disturbed for ten days At the end of this period during which antiseptic mouth-washes are used at frequent intervals, more particularly after meals, the retention plate is removed and the mould taken out with care The newly-epithelialized sulcus is gently irrigated with a mild antiseptic lotion and a new mould of guttapercha is fixed in position

At this stage it often appears that the graft has not 'taken' for the surface may appear still raw and tend to bleed slightly, even in cases which prove to be perfectly satisfactory later on   After two days more the same procedure is repeated, with the exception that the mould is not renewed   After this the sulcus is irrigated daily, usually by the patient himself   The mould is kept in position until the dentist is ready to replace it by his denture   It is surprising how rapidly the newly-formed sulcus will become obliterated in the early stages of its existence unless some mould is retained   Later on this tendency disappears entirely, and patients are returning to us now for further treatment who were operated on twelve to eighteen months ago, and who exhibit perfectly epithelialized sulci with no tendency whatever to diminution of their depth

In conclusion it may be remarked that success is only to be obtained by close co-operation between surgeon and dentist—a co-operation which has been found absolutely indispensable at Sidcup

SUMMARY

Numerous cases of war wounds have been encountered in which the alveolar sulcus has been obliterated

Efficient functional dentures cannot be provided

Many analogous cases appear from time to time in civil practice

All can be effectively treated by the method of skin grafting here advocated, the field of usefulness of which remains still incompletely explored

SHORT NOTES OF RARE OR OBSCURE CASES

CYSTIC ADENOMA OF THE BILE-DUCTS

By ARTHUR EVANS, London

Tin patient, a married woman, age 53, was admitted into Westminster Hospital, Nov 20, 1919 She had ten children and had had one miscarriage

Following influenza in November, 1918, she had suffered from pain in the upper abdomen, with occasional attacks of vomiting, and slight jaundice There was no history of hæmatemesis, nor of melæna The patient was constipated

On admission the patient was emaciated and looked ill, she was slightly jaundiced She complained of constant pain in the upper abdomen The edge of the liver was palpable below the right costal margin Apparently continuous with this, and extending into the epigastrium, was a smooth rounded tumour which reached almost to the umbilicus The tumour was dull on percussion, and appeared to be fixed posteriorly There were no abnormal physical signs in the lungs The temperature and the pulse were normal
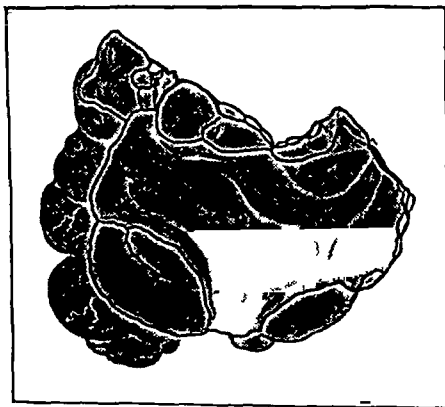
Fig 117 118 —One cluster of the small cysts which were detached from the inner wall of the large liver cyst

Urine —
1 Cammidge reaction osazone crystals found
2 Amylase reaction D 38° 30″ = 13 units
3 Cammidge reaction after 24 hours' fermentation typical small Cammidge crystals seen Control negative

Test meal —Over 200 c c recovered from stomach Faint trace of HCl present Lactic acid present Estimated in terms of HCl acidity due to HCl, 0 02 per cent total acidity 0 1 per cent acidity from organic acids, 0 08 per cent Solid matter Starch fat debris, squamous cells yeasts, torulæ No marked excess of bacteria, no sarcinæ no Oppler-Bois bacilli seen

Fæces —No reaction for occult blood No pus found Moderate amount of fat Microscopically food debris, granular detritus, bacteria, no pus or blood
Blood —
1 Leucocyte count total 13 700 per cmm Polymorphs neutrophils, 75 per cent,

eosinophils, 1 per cent = 76 per cent   Monomorphs   large, 5 per cent , small, 18 per cent = 23 per cent   Transitional, 1 per cent

2 Wassermann reaction   negative

OPERATION —Dec 1, 1919 —Median supra-umbilical laparotomy   Free fluid of a myxomatous nature was found in the peritoneal cavity   The tumour proved to be a large thick-walled cyst attached to the under surface of the liver   It was so large and tense that one's fingers could not be inserted between it and the vertebral column   When opened, a large quantity of viscid fluid escaped   The examining finger felt what were at first thought to be daughter cysts attached to the inner wall , but these proved to be so intimately adherent to the cyst-wall that clusters of these cysts could be detached only with great difficulty
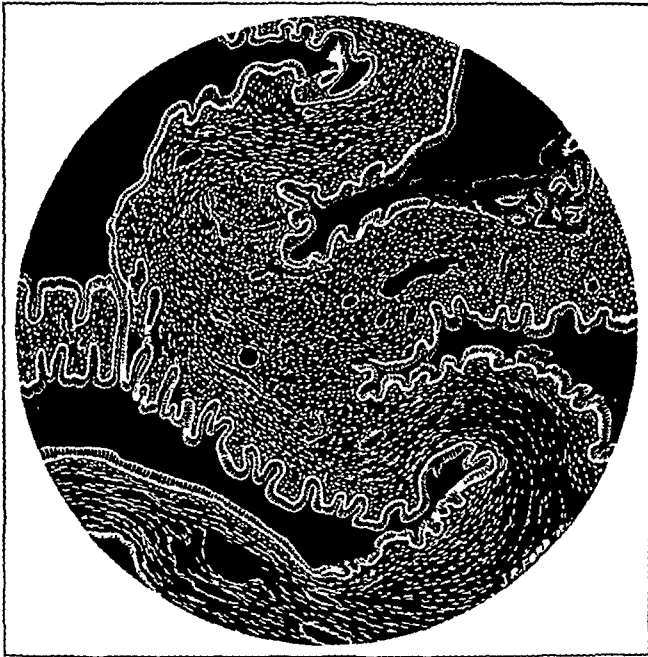
FIG 149 —Microscopical section of the cystic mass shown in *Figs* 147 148 Note the well formed non ciliated mucin secreting columnar cells which line the cysts   The stroma consist of coarse fibromuscular tissue

The attachment of the cyst to the under surface of the liver was fully six inches in all its diameters, and to attempt its complete removal was considered unjustifiable   The greater portion of the cyst-wall and its contents were removed , and into the remaining portion of the cyst a large rubber drainage tube was sutured

The patient made an uneventful recovery   A sinus has persisted and from this some clear viscid fluid constantly drains

PATHOLOGICAL NOTES (Dr J A Braxton Hicks) —The fluid was semi-gelatinous, dark brownish green in colour   The deposit showed red corpuscles, degenerated leucocytes, cells and clumps of cells of an endothelial type   No scolices or hooklets were seen   Some of the free cells stained in a fresh specimen presented a peculiar appearance   They possessed a well-defined clear ectoplasm and a granular endoplasm   In the endoplasm were oval parasitic-like bodies giving dark granular staining with methylene blue   Repeated examinations proved these to be merely degenerations of the columnar mucin-forming cells of the cyst tumour

When the cystic mass was received in the laboratory it looked not unlike a small piece of a multilocular ovarian cyst (*Figs* 147, 148)   Sections showed the tumour to be made up of cysts lined with well-formed non-ciliated columnar cells, which could be seen secreting mucin   The interstitial tissue supporting the cysts consisted of coarse fibromuscular tissue (*Fig* 149)

The tumour is a multilocular cystic adenoma arising from the bile ducts

This condition is very rare   Only one case has hitherto been reported in England by Walker Hall and Brazil [1]   Keen and Ziegler [3] describe and illustrate similar cases

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A CASE OF SPLENOMEDULLARY LEUKÆMIA

By R E KELLY, Liverpool

The extraordinarily interesting paper on the surgery of the spleen by Sir Berkeley Moynihan in the last number of the BRITISH JOURNAL OF SURGERY prompts me to place on record the following case I offer it as a further example of the changes seen in the blood and bone marrow in association with splenic disease In addition, the case seems to present some curious features (1) A marked amelioration of symptoms after a course of x-ray treatment to the spleen , (2) A spontaneous fracture of the jaw (3) Associated 'myelopathic albumosuria'

The patient Mrs X , was sent to me by Dr E W Lewis, of Southport She is 52 years of age, and, until the present illness, has been fairly healthy but never robust There is nothing apparently pertinent in the family history She has two children, 21 and 10 years old respectively

Eleven years ago, in February, 1910, she began to suffer from anæmia, and was diagnosed as a case of splenomedullary leukæmia She was ordered a complete rest and at the end of a year she says she " was in fair condition except for the anæmia and the enlarged spleen" One doctor stated that in February, 1911, "there were many myelocytes in the blood", and another doctor, in May, 1911, that " the hæmoglobin was over 70 per cent, the red cells 3,800,000, with obvious and considerable leucocytosis "

In November, 1912, she was sent to Dr Thurstan Holland for x-ray treatment for the condition , and I am indebted to him for the following notes

" Duration of the enlarged spleen about two years Spleen well over the mid-line Splenic notch above and to the right of the umbilicus Lowest border 7 cm below the level of the umbilicus

1912, November and December,	11	exposures to spleen		
1913, January to December,	27	,,		,
1914 ,, ,	10	,,		,,
1915 ,, ,,	9	,,		,,
1916, January to May 26,	2	,,		,

Each dose was about 1 S with a tube of medium hardness, but filtered through three layers of thick felt

Blood counts

Nov	29, 1912	Reds	3,400,000	Whites	72,000		
Dec	29, 1912	,,	2,160,000	,,	80,000		
Jan	15, 1913	,,	4,900,000	,,	7,000		
Mar	11, 1913	,	3,904,000	,,	7,000		
Nov	11, 1913	,,	4,600,000	,	5,900		

Spleen November, 1912, after three treatments, spleen a good deal smaller
  December 13, 1912 Spleen well over to the left side Then follow many records of 'rapid diminution of the spleen'
  December 1913, spleen not to be felt
  1916 —Patient perfectly well Spleen not felt
  The same note on May 26 1916 when all x-ray treatments were stopped '
Dr Holland also saw the patient in June, 1919 His note runs " Quite well Good colour Spleen normal in size

To return to the patient's own narration At the end of 1916 she felt perfectly well, her blood counts were normal, and she could walk ten miles with comfort
For over three years she remained apparently perfectly well
In July 1920 she noticed that she was more easily tired A little albumin was found in the urine at this date Some weeks later she complained of pain in the right iliac fossa It was noted that the spleen was a little enlarged She ran a temperature

for six weeks   Although there was no examination of blood for the Widal reaction, this attack was diagnosed as typhoid fever

On December 11, 1920, she noticed for the first time a slight swelling in the lower jaw   Eating and talking were painful   The swelling gradually increased in size until on Christmas day, whilst eating a piece of bread and butter, she felt her jaw crack   Since then she has felt no further cracking   A loose tooth in the region of the swelling has been removed, and on two occasions the swelling was incised under the impression that it was a dental abscess   Blood only exuded from the incisions

The foregoing is as complete an account as I have been able to gather of her past history   The interesting points are the diagnosis, the disappearance of the splenic enlargement, the disappearance of the leucocytosis, the attack of fever, the presence of albumin (or was it really albumose?), and the development of the jaw swelling

When I saw her on January 21, 1921, she had an obvious fracture of the jaw just behind the last molar tooth on the right side, with the usual displacement of the posterior fragment inwards and the distal fragment downwards (*Fig* 150)   The fracture was not at all painful   She could talk comfortably and eat remarkably well

An x-ray photograph showed that there was a tumour at the site of the fracture   This tumour was about the size of a walnut   It had absorbed and thinned out the compact bone, which was slightly expanded at the fracture   The mucous membrane was normal over the growth   There was no attempt at union   Otherwise the patient looked fairly well   She was anæmic, and the spleen could easily be felt about one inch below the costal margin   The spleen felt somewhat harder than normal

No sign of any primary malignant growth was detected in breast, abdomen, uterus etc

Fig 150 —Skiagram showing the tumour at the site of fracture

A blood count kindly taken by Dr J C Matthews showed red blood-cells 4 500,000, normal morphologically, white cells 12,000 per cmm

Differential Count	Per cent	No per c mm	Normal
Polymorphs	54 5	6540	6500
Lymphocytes (large and small)	33	3960	2500
Monocytes	12	1440	800
Basophils	5	60	100

In other words, distinct relative and marked absolute lymphocytosis   Slight monocytosis   No myelocytes or metamyelocytes found   Polymorphs show *free* division of nuclei   Arneth count = right-hand deviation

Examination of the urine shows the so-called *myelopathic albumosuria*   Equal parts of salicyl sulphonic acid and urine give a flocculent protein precipitate which clears on boiling and reappears on cooling   If the urine is acidulated with a drop of weak acetic acid and heated in a water-bath, the protein is thrown down as a white precipitate

at about 60° C   This precipitate almost clears on boiling, and reappears on cooling (Bence-Jones' proteid)

Similarly nitric acid and hydrochloric acid both precipitate the proteid in the cold, which precipitate is cleared on boiling   In this particular urine, however, the protein is not precipitated by half saturation with ammonium sulphate   The urine also shows the presence of urobilin , an indication of hæmolysis or some tissue deficiency   There is no evidence of sugar, bile pigments or salts or acetone   (I am indebted to Dr Coope for the urinary examination)

This curious protein body in the urine (myelopathic albumosuria of Bradshaw) was first noted in the urine by Bence-Jones in 1847   It is a proteose, and is said to be one of the products of proteolysis on the way to the peptones and polypeptides   It occurs in the urine in cases where there is any absorption of partially digested pus in cases of empyema, pneumonia, etc , and in cases where there is tissue breakdown   It is also said to be diagnostic in myelomata and sarcomata of bone   Dr T R Bradshaw[1] states that " the presence of albumose in the urine is one of the few signs of disease which can strictly be called pathognomonic, admitting, as far as our present knowledge goes, of only one interpretation , and it is usually for many months the only indication of the true nature of the disease from which the patient is suffering, and may for a long time be the sole evidence that he is seriously ill at all   Multiple myelomata, the morbid condition of which it is the sign, goes on to a fatal termination with the certainty of malignant disease, and no measure hitherto attempted appears to have the slightest influence in retarding its progress

An x ray of the chest revealed no definite shadows of other myelomata in the ribs the usual situation of these growths

The interest of this case lies in the diagnosis, and the question whether the two diseases leukæmia and myelopathic albumosuria are related, or independent of each other

Further points of interest are the extraordinary effect on a leukæmic spleen of a course of x rays , and, lastly, the consideration of the prognosis   I think it grave

ADDITIONAL NOTE—MAY 6, 1921

This patient died on May 4, 1921

Unfortunately, no post-mortem was obtainable   The tumour of the jaw increased to about twice its size, but there was no ulceration of the mucous membrane   There were no clinical signs of other tumours   During the last week of her life she suffered from persistent vomiting and diarrhœa   Myelopathic albumosuria was still present a month before she died

REFERENCE

[1] T R Bradshaw *Brit Med Jour* 1906, Nov 26

A CASE OF TUMOUR OF THE CAROTID BODY

By GEOFFREY KEYNES, London

Tumours of the carotid body are uncommon, and relatively few cases have been recorded in surgical literature   Keen and Funke[1] collected twenty-nine cases in 1906, and Callison and McKenty[2] added a further thirty-one to the series in 1914   A perusal of the published accounts of these cases produces a feeling of doubt as to whether they have all been correctly diagnosed, and it is probable that the actual number of cases recorded in which the diagnosis of a tumour arising from the carotid body is clearly correct is considerably less than sixty   It is therefore worth while recording the history and treatment of another case in which the origin of the tumour was beyond doubt

The patient, a married woman of 31, had noticed a lump in the left side of her neck

for rather over two years, and recently had had transient but severe attacks of aching pain in the left side of her neck and face   In September, 1920, she was admitted to a country hospital, but the growth was regarded as inoperable, she was advised to have treatment at the Radium Institute, but for various reasons this was not carried out   In November, 1920, she was admitted to St Bartholomew's Hospital, and was then obviously suffering in general health   She was thin, had a poor appetite, and slept badly   She had a solid tumour of a very hard consistency, lying deep to the left sternomastoid muscle and extending from the angle of the jaw to the level of the cricoid cartilage   It could be moved from side to side, but was fixed in the vertical plane   Arterial pulsation could be felt, but it was clearly transmitted and not expansile   There was no evidence of any infiltration of the sympathetic or recurrent laryngeal nerves   but, as already mentioned the patient suffered considerable pain, presumably from pressure on sensory branches of the cervical plexus   No other swellings suggesting glandular involvement could be felt   The diagnosis remained in doubt, but an exploratory operation was advised, as the tumour was thought to be of an innocent nature

On November 26 the tumour was exposed and found to be encapsulated and very hard   It was easily freed from all the neighbouring structures except the carotid vessels all three being completely surrounded by the tumour, the central point of which seemed to correspond in position to the bifurcation of the common carotid artery   It was evident that the tumour could only be removed after ligature of all these vessels, but unfortunately the risks attending this procedure had not been previously explained to the patient, and it was felt that without this the operation could not justifiably be completed

Among the 60 recorded cases of carotid body tumour, all three carotid vessels were ligatured in 32 cases, in 4 of these hemiplegia and aphasia followed the operation, and 2 died from cerebral anaemia   That is to say, there were very serious sequelae in 19 per cent of the cases   In the present instance the patient was comparatively young and presumably had a good col lateral circulation, but the fact that the cerebral circulation reaches the brain only through bony fora mina, and cannot, therefore, be increased by any expansion of the remaining vessels after ligature of one common carotid artery, seems to be a valid reason for regarding the operation as dangerous at any age   One of the four patients mentioned above, who acquired a hemiplegia, was a child, age seven
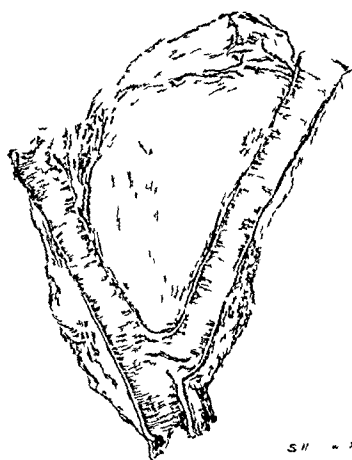
Fig 151 —Tumour of the carotid body
Mesial section   (Natural size)

In the present case, accordingly, the wound was closed, to be re opened a week later, when the tumour was readily removed after ligature of the common carotid, of the internal carotid, and of the individual branches of the external carotid as they emerged from it   It was intended to follow the advice given by Sir George Makins,[3] and to attempt to safe guard the patient's cerebral circulation by first ligaturing the internal jugular vein, but after freeing the tumour from the adhesions which had formed since the first operation severe haemorrhage from its surface occurred, this could not be easily controlled owing to the hardness of the growth, and the main vessels therefore had to be ligatured as rapidly as possible   There did not seem to be any point after this in prolonging the operation by ligaturing the vein

After the operation the patient suffered from no symptoms of interference with the functions of the left cerebral hemisphere either immediately or subsequently   She made an uneventful recovery, and left hospital on December 21   She has been examined at intervals since that time and up to the present shows no signs of weakness or of recurrence She is free from pain, and is able to perform her household duties   A paresis of the left depressor anguli oris due to section of its nerve-supply is gradually disappearing

PATHOLOGY —The tumour, after being hardened, weighed 23 grm , and, as can be seen in the accompanying full-size drawing (*Fig* 151) of a mesial section through it, completely enveloped all three carotid vessels   Microscopic sections (*Figs* 152, 153)
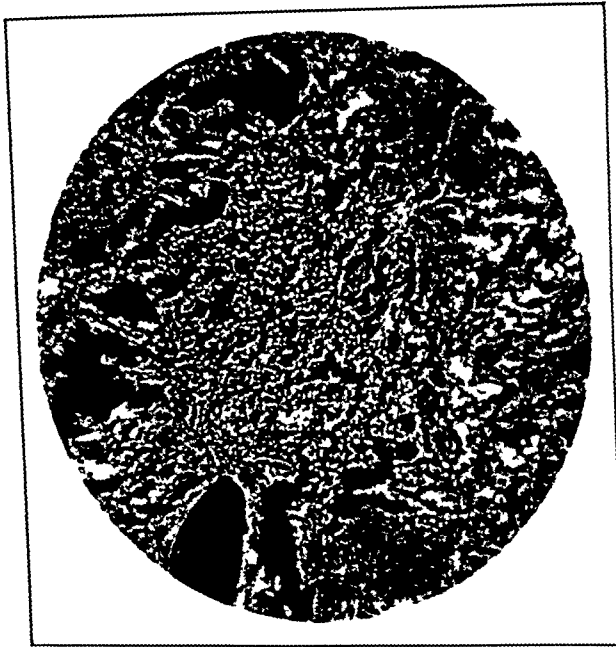
FIG 152

FIG 153

show that the growth has not transgressed its capsule, and that it is not very cellular, but contains a large proportion of fibrous connective tissue   It shows a large number of spaces lined by the tumour cells or by endothelium, and some of these contain blood   The cells are of fairly uniform size, and seem to have no characters

suggesting sarcoma   In general the growth is of an innocent endothelial type, and conforms in position and in structure to the accepted description of tumours arising from the carotid body

In many of the recorded cases the growths were definitely malignant, but there is some evidence to show that they were innocent in their early stages   Recurrence followed in most of the cases in which an attempt was made to dissect the tumour away from the carotid vessels   The history of this case encourages the belief that a carotid-body tumour, if diagnosed early enough, may be successfully treated by complete removal, with ligature of all the carotid vessels

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[1] KIEV W W   and FUNIL, J ' Tumours of the carotid gland ', *Jour Amer Med Assoc* 1906, xlvii 469 566

CALLISON J G , and MACKENTY, J F ' Tumours of the carotid body ", *Ann of Surg* 1914 lix 740

[3] MAKINS SIR G H , *On Gunshot Injuries to the Blood vessels*, 101   Bristol   Wright & Sons Ltd 1919

RENAL   CALCULUS   HORSE-SHOE   KIDNEY   HEMINEPHRECTOMY

BY   L   BATHE   RAWLING,   LONDON

THE patient, a man age 25, states that he was operated on for stone in April, 1920, ' several phosphatic stones being removed from the pelvis of the right kidney '—this from notes of the case   During the past few months he has experienced several attacks of renal colic, pain in the right iliac region shooting down the thigh, with nausea and vomiting during the attacks   The skiagram showed several stones in the right renal pelvis

Cystoscopic examination showed a normal left ureter, whilst the orifice on the right side was obscured by a phosphatic crystal, and the urinary outflow was small and delayed Abdominal examination showed that the right kidney was enlarged nodular, oblique in position, and low down in the iliac fossa

A diagnosis was made of right renal calculi, with nephrectomy as the correct surgical procedure

The usual lumbar incision was made, the upper pole of the kidney being exposed, freed, and delivered   On attempting to treat the lower pole of the kidney in a similar fashion, it was noted that the obliquity of the kidney was remarkable, and on further endeavour it was found that the kidney substance passed across the vertebral column and was directly continuous, without sign of constriction, with the left kidney

The right half of this mass was delivered, with considerable difficulty and with some renal laceration   This portion contained, so it was hoped, all the calculi present   The mass was 'crushed' at or near the middle line, anything entering the kidney along its upper border being ligatured as encountered

The patient made an uninterrupted recovery, the wound being healed within a month of the operation

REVIEWS AND NOTICES OF BOOKS

Orthopædic Surgery of Injuries By Various Authors Edited by Sir Robert Jones, K B E, CB, FRCS 2 vols Royal 8vo Pp 1232, illustrated 1921 London Henry Frowde Hodder and Stoughton £4 4s net

The enormous development of orthopædic surgery, which has been one of the results of the recent war, and the fact that no publication has been issued dealing in bulk with the various departments of orthopædic surgery, make the present work a most valuable addition to surgical literature The subject is dealt with in two volumes, each profusely illustrated, the first containing amongst other items, a foreword by Director General T H J Goodwin the editor's preface, and a chapter on the Principles and Practice of H O Thomas" Sir Robert Jones in his preface, points out that during the war the number of beds reserved for orthopædic cases rose from 250 to over 30 000 thus showing the importance that this class of work has assumed during recent years To many who are still dealing with the results of injuries of war the work will be of the utmost value and aid, and the fact that each subject is dealt with by authors who have had special experience in these subjects, assures the reader of the most modern views upon the surgery of injuries The chapter on the Principles and Practice of H O Thomas" is full of interest and information, showing as it does that he was perhaps the father of orthopædic surgery in this country, not only as an operating surgeon, but also as one who made his own splints fitted them to his patients, and followed each individual case to its termination Thomas had the true orthopædic mind, for as Sir Robert Jones say in his preface, the orthopædic surgeon is trained to think in terms of function The orthopædic surgeon, too, has to deal largely with the pre and post operative stages of his cases, and it was perhaps in this that Thomas excelled He died at the early age of 47, leaving behind him, amongst many other results of a life's work, the famous Thomas's knee splint It might be said that the adoption of the Thomas's knee splint for injuries to the lower extremity during the recent war was one of the greatest steps forward in the treatment of the badly wounded man

With so many chapters written by authors of such experience, it is difficult to mention any one which is particularly outstanding In Volume I the chapters on "Splinting", "Ununited Fractures ', "Malunited Fractures ", and the Treatment of Flail and Ankylosed Joints" are especially good Volume II is devoted chiefly to the injuries of the nervous system, and includes an excellent chapter on the ' Operative Treatment of War Injuries of the Peripheral Spinal Nerves " There is also a chapter on the Organization of Curative Workshops ', showing clearly the advantages to injured men of using their limbs at the earliest possible moment, not merely by set exercises, but by producing at the same time tangible and useful results

The whole work is excellently arranged, and each subject fully dealt with from a practical point of view The fact that Sir Robert Jones—the leading orthopædic surgeon of the day, one who has devoted the whole of even his enormous energy to the subject during the war, and who has brought orthopædic surgery into the prominent position that it holds to day—has edited this work, is a sufficient guarantee of its excellence Added to this the names of many of the authors the clear and practical way in which most of the chapters are written, and the excellent illustrations, make the work the leading publication of the day upon this subject

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Diseases of the Throat Nose, and Ear By Dan McKenzie, MD, FRCS Large 8vo Pp 646 With 2 coloured plates and 199 figures in the text 1920 London William Heinemann 42s net

The author has laid senior students and practitioners under a debt of gratitude in providing them with an excellent exposition of these diseases No other book we know presents this information so concisely, and with such good illustrations

Chapter 1 contains many useful observations on note taking and general semeiology

Chapter 2 deals with the examination of the buccal cavity, fauces, and pharynx We are surprised that the author retains the term 'supratonsillar fossa' when it is well recognized that the recess lies within the capsule of the tonsil and is often lined completely with glandular tissue The illustration (Fig 4) of a peritonsillar abscess is misleading, because the soft palate does not appear to be affected, and yet it is in this particular peritonsillar region that the abscess and swelling are so characteristic

In the section on diphtheria more emphasis might be laid on the advisability of giving maximum doses of antitoxin directly the diagnosis has been made In describing the removal

of enlarged tonsils, the author will find many who do not agree with his methods   Even in hospital practice, where many cases must be enucleated by the guillotine in a limited time, we cannot see any advantage in operating with the patient in the sitting position   With regard to enucleation by dissection, the illustrations leave much to be desired, and it is surely contrary to general experience when he states that   it is a more severe operation than enucleation with the guillo tine , the risks of sepsis are greater , and the subsequent scarring is more deforming to the fauces and palate "

It is inaccurate to state (p 607), that generally the bleeding point "is located on the posterior aspect of the anterior faucial pillar ", because the almost constant source of arterial hæmorrhage is from the tonsillar branch of the descending palatine artery which is situated (and divided in operation) in the outer half of the upper and posterior wall of the bed of the tonsil   On p 61 we are advised that if the application of the artery forceps has not checked the bleeding, we should ' reapply the forceps and either ligature or leave the forceps *in situ* for several hours "   We can only say that bleeding can always be stopped by ligature at the time of operation, and nothing would persuade us to adopt the other alternative

Again, in reactionary hæmorrhage we are advised that Watson Williams's clamp should be firmly and accurately applied   and left on for three or four hours   Has the author ever practised this in a child ?   As a last resort, when other methods fail, ' the external carotid artery should be ligatured '   We should like to know if the author has ever found this necessary, and, if so whether the operation stopped the bleeding ?

The sections on cancer, syphilis, and tuberculosis of the pharynx are well written, and the value and place of diathermy is a method of treatment insisted on

Chapters 4 and 5 are devoted to the larynx—the methods of examination and the diseases of that organ   Our present day knowledge of the subject is concisely stated and well illustrated Here we must make a criticism, which applies to the whole volume, as to the somewhat careless or unbalanced way in which the names of pioneer workers are often omitted while those of others are mentioned   For example, in the discussion of carcinoma and paralysis of the larynx we find no mention of Butlin, Semon, and Horsley—men who practically established our knowledge on these subjects—while Mr Stuart Low and Mr Trotter are given credit for pointing out the value of digital examination in carcinoma of the larynx whereas it was Dr J W Bond who emphasized this point at least twenty years ago   And why should not Dr Albert Gray and Mr Sidney Scott be honoured by mention for their work on otosclerosis and the labyrinth respectively ?

In *Chapter* 6 on the examination and affections of trachea, thyroid body and œsophagus a clear, concise, and practical account of these subjects is given, but we question how far it is advisable for the laryngologist to extend his domain to the surgery of the neck

The section dealing with the œsophagus is excellent, but among the symptoms of the so called œsophageal pouch' the author does not mention the characteristic 'gurgling noise which follows the drinking of fluids , and we think he could give us a better illustration of a 'pouch' than *Fig* 55

To *Chapter* 7, dealing with the examination of the nose and nasopharynx, and general therapy of the nose, we would have given unstinted praise but for the flagrant anatomical errors on p 217   The infundibulum and frontonasal duct are used as interchangeable terms, whereas they are distinct and often independent anatomical structures   the former is a gutter bounded on its median aspect by the uncinate process , the frontonasal duct is a closed canal leading from the frontal sinus into the upper and interior region of the middle meatus

We are glad to note that the value of endoscopy receives due notice, and that its advantages as well as its limitations are pointed out by one who speaks from practical experience of the use of this mode of examination

Chapter 9 is concerned with the accessory sinuses   The author is to be congratulated on his exposition of this important branch of rhinology

The sections devoted to the maxillary antrum give an excellent account of its diseases and the operative treatment which may be demanded   But many statements are made which are not in accord with general experience e g , in discussing exploratory intranasal puncture of the antrum the author states that   bleeding from the cannula is highly suggestive of polypoid degeneration of the lining membrane "   We should have thought it pointed more directly to the possibility of malignant disease   He prefers nasal antrostomy   for practically all cases of antrum suppuration ", whereas many experienced operators have relinquished the intranasal route for the more direct opening in the canine fossa (Caldwell-Luc) because the latter provides a full view of the field of operation   It is not our experience that after the canine fossa operation convalescence is slow, or that facial neuralgia is a complication to be feared

Chapters 11 to 14 are devoted to diseases of the ear, and this is the best section in the book Dr McKenzie gives an excellent and practical account of the methods of examining the ear which will afford a safe guide to the student and practitioner, and the same may be said concerning what is known with regard to the normal and pathological reactions of the vestibular system   The illustrations of operative procedures are the best we have seen   There is little to criticize adversely in this section   In the operative treatment of exostosis of the meatus we should prefer to approach the obstruction through a post aural incision rather than by chiselling through the meatus and risking a long course of treatment for the discharge and granulations which operation by that route is liable to involve

The author is one of the first to emphasize, in print, the importance of detecting and treating serious catarrh of the tympanum before it has had time to set up permanent changes in the middle ear which may lead to incurable deafness, tinnitus etc   But we think the observer will rarely see the fluid level so clearly as is depicted on p 161

Dr McKenzie advises leeches over the mastoid in the earlier stages of acute inflammation in the middle ear, but he does not point out that the ædema which results from their bites may suggest inflammation in the mastoid cells   We wish that he had extolled the value of suction with the Siegel's speculum after puncentesis of the membrane, because by this means it is often possible to remove a quantity of pus from the tympanum and its adnexa

Unstinted praise may be given to the description of the symptoms, diagnosis, and operations in relation to the meningeal and cerebral complications of acute and chronic inflammation of the tympanum and its adnexa

Chapter 14 on nerve deafness and labyrinth disease is full of useful information   it should be studied by all who are interested in diseases of the ear

In *Chapter* 16 we have a useful account of the commoner diseases of the mouth, salivary glands, and the palate, which often come under the notice of the ear and throat specialist during routine examination   Even if the treatment of some of these conditions is outside his province it is nevertheless essential, and often to the benefit of the patient, that the significance and bearing of pathological conditions of the mouth, tongue, and salivary glands should be recognized

In conclusion, Dr Dan McKenzie is to be heartily congratulated on having successfully accomplished a difficult and almost unique task, in that he has given us in one well illustrated volume an excellent account of the diseases of the throat nose and ear   Furthermore, this has been done in easy and fluent style, and yet with an atmosphere of conviction which can only be derived from personal experience

The Catarrhal and Suppurative Diseases of the Accessory Sinuses of the Nose   By Ross HALL SKILLERN, M D , New York   Third edition   Large 8vo   Pp 418 + xvii, with 300 illustrations   1920   Philadelphia and London   J B Lippincott Co   30s net

In this third edition of his well known work, the author has presented the profession with the most complete work on the subject in the English language

The book is not a mere compilation of what is known of the anatomy, physiology, and pathology of the nasal accessory cavities, but the reader profits throughout by the ripe experience and enthusiasm of the author which is always held in check by well balanced judgement   The type is clear, one is never in doubt as to the author's meaning, and the 300 illustrations could scarcely be improved upon

Part I is devoted to ' General Considerations "   It embodies a careful, accurate, and practical description of the anatomy, physiology and development of the nasal cavities and their accessory sinuses   But why does Dr Skillern so frequently use the word 're-absorption' of bone in describing the development of the sinuses ?   Surely *absorption* is fully significant and more accurate

The section on the bacteriology of the sinuses is excellent   He points out that while the primary inflammation of a sinus may be caused by a certain organism, e g , the influenza bacillus, yet the continuance of that condition may be due to a secondary infection by other organisms which find the ground suitably prepared for them while the primary agent of infection may long since have disappeared   Furthermore, the type or types of organisms may often change during the course of the disease

In discussing the symptoms of sinus inflammation, Dr Skillern rightly lays stress on the fact that a constant or frequent headache should always lead to a careful examination of the nasal cavities and their sinuses, and he is impressed with the frequency with which pressure on the septum from mucous membrane hypertrophies causes headache

On the other hand, we do not share his experience when he says he   has never observed such a case   is chronic purulent inflammation of the sinuses without any headache, while we are fully in accord with him when he states that all cases of 'tic' are not caused by sphenoidal-sinus inflammation is maintained by some rhinologists

His views as to the unreliability of transillumination in the diagnosis of sinus inflammation will be upheld by all careful workers   He rightly extols the value of radiography, and points out its reliability in diseases of the ethmoid sinuses, in establishing the presence or absence of certain types of dental disease, and in revealing the presence of new growths in the sinuses

The section on the " Complications of Sinus Inflammation " is excellent and particularly so with regard to orbital affections

We are glad to see the writer draws attention to sinus disease in children, in aspect of the subject which has been so constantly overlooked by many other authors

Part II is devoted to the anatomy and diseases of the maxillary antrum   These are given in full detail and the illustrations are excellent

We do not agree that disease of the antrum of dental origin is always chronic from its inception '   because an acute antral suppuration is often the culminating point of an acute dental inflammation   It is regrettable that the author lends the weight of his authority to an injection' after needle puncture in diagnosis and treatment, because some twelve deaths have

been recorded is a result of air embolism following the employment of this method   The reviewer had one alarming case of aphasia and right arm and leg hemiplegia lasting for an hour, and since then has always irrigated with a warm normal saline solution

Nor do we see the advisability of packing the antrum with gauze after any intranasal or extra nasal operation   The object of these procedures is to provide for free and permanent drainage to insert packing means that before the patient is off the table the gauze is saturated with blood and septic secretions with the result that post operative swelling and œdema of the cheek frequently results, to say nothing of the pain which is caused when the packing is removed

Excellent descriptions of the various radical operations are given, and full directions as to inducing local anesthesia in preference to general narcosis   It is unfortunate that the former method cannot annul mental anticipation and anxiety, and on this account we are of opinion that local anesthesia for major operations on the accessory sinuses should be reserved for very exceptional circumstances if the services of an expert in general anesthesia can be secured

Part III is devoted to the frontal sinus, and is of the same high standard as that which characterizes Part II, but once more we take exception to the author's advice that after inserting the cannula in the sinus   the syringe is filled with air and the latter forcibly inflated into the sinus cavity"   We agree with him that transillumination of the frontal sinus is of little value compared with radiography in establishing the presence of inflammatory changes

The pros and cons of the intranasal method of operating on the frontal sinus are clearly defined, and the young rhinologist will do well to bear in mind the author's warning   'The various intranasal operations described above require a skill and proficiency that are only obtainable after the sacrifice of a considerable amount of time and trouble by numerous experimental operations on the cadaver'

The various intranasal operations, as well as those performed outside are profusely illustrated

Parts IV and V are devoted to the ethmoidal and sphenoidal sinuses respectively, and it will suffice to say that the subject matter and the illustrations deserve the same praise as that which has been bestowed on Parts I and II

To Dr Skillern's book the expert will often turn when in need of information concerning details of pathology treatment, etc, and also because of the large number of useful references to the work of other rhinologists   The younger worker in this department of surgery will find in the volume a mine of information and a sure and safe guide in his practice

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Text book of Tracheobronchoscopy (Technical and Practical)   By Dr M Mann (Dresden Friedrichstadt)   Translated by A R Moodie   F R C S (Edin)   4to   Pp 292, with 50 illustrations in the text and 15 plates (10 coloured)   1920   London   John Bale, Sons & Danielsson Ltd   31s 6d net

THE author states that his aim is to show that tracheobronchoscopy is no longer merely a technique by which one is able to remove foreign bodies from the air passages, but is a method of investigation in the study of numerous diseases of the thorax   In this we think he has succeeded

Part I deals with the technique of tracheobronchoscopy   In this are included anatomy history, instruments, and other details concerning the direct method of endoscopy

He briefly reviews the various modifications introduced by European workers as well as those of Chevalier Jackson and Ingals in the United States, but one infers that he has not availed himself of the advantages of distal illumination as opposed to the proximal source of illumination used by the Killian school   He makes no mention of work done in Great Britain and Ireland in tracheobronchoscopy—a serious omission in a scientific treatise

In Chapter 4 on the preparations for tracheobronchoscopy, the author rightly urges the need for a careful general examination of the patient before endoscopy is practised, and this should include radiography   He contends that anesthesia is indicated before the introduction of the bronchoscope and in this opinion we are in accord with him   A 20 per cent solution of cocaine is advised, and it is applied with a hair brush   A 1 per cent solution of the harmless double salt of quinine and urea, with the addition of adrenalin solution (1–10), is extolled as a rapid and efficient anesthetic for the tracheal and bronchial mucous membrane

He says that the question of local or general anesthesia varies according to the experience and skill of the observer, but we should be inclined to add that the choice will depend largely on the nature of the case and the temperament of the patient

Dr Mann states that 'chloroform is the only anesthetic that can be recommended, as ether irritates the bronchi and stimulates the secretion   We wonder if he has ever tried ether preceded by a hypodermic injection of $\frac{1}{100}$ gr of atropine administered thirty to forty minutes before the administration of the general anesthetic?   We believe he would soon be converted to the advantage of obtaining deep narcosis by such a stimulant as ether and then continuing the anesthesia with chloroform for the actual period of operation

Pp 47–53 are devoted to the methods of introducing the bronchoscope in the sitting or recumbent positions

With regard to tracheobronchoscopy in children, the author omits an important warning viz, to use the smallest tubes consistent with obtaining a satisfactory result   The inexperienced operator is inclined to use the largest tube possible and this frequently leads to post operative œdema of the subglottic region with grave risk of dangerous dyspnœa

Part II is concerned with the practice of tracheobronchoscopy *Chapter* 1 cites the salient features of a number of cases in which different types of foreign bodies have been removed by endoscopists in various parts of the world A useful summary of the practical conclusions to be drawn from the cases is given

Chapter 2 is devoted to tracheobronchoscopy in diseases of the bronchial system This is perhaps the most useful portion of the book in that it shows that endoscopy is not nor should be, limited to dealing with foreign bodies, because it has proved to be of immense value in the diagnosis and treatment of pathological conditions of the lower air passages Epranims results in the treatment of chronic bronchitis and asthma are worthy of serious consideration and emulation We think the author should have emphasized the fact that unilateral bronchiectasis in children is more often than not due to a foreign body lodged in a bronchus or in one of the bronchial tubes

An excellent series of coloured plates which illustrate normal appearances and pathological conditions concludes the volume

The value of a future edition would be enhanced (1) if the literature of the subject were brought more up to date so that endoscopists could depend on the volume as a reliable source of reference, and (2) if the author could see his way to illustrate some of the excellent instruments invented, and refer to the valuable communications which have from time to time been recorded by English speaking workers in this special branch of laryngoscopy

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Six Papers by Lord Lister with a short biography and explanatory notes By Sir Rickman Godlee, Bart, K C V O M S Medical Classics Series Cr 8vo Pp 194 + xii 1921 London John Bale, Sons & Danielsson Ltd 10s net

This little volume appears as the first of a series of Classics of Medicine, the aim of which is to place in the hands of the reader some of the most epoch making contributions to medical science The general editor of the series is Dr Charles Singer Lecturer in the History of Medicine Univer sity College, London The name of the author is a sufficient guarantee of the excellence of this first volume of the series Lister's place in history is put before the reader in a short account which explains the condition in which Lister found surgery and that in which he left it It enables the student to understand the relation of Lister's work with that of Pasteur for whom Lister entertained the most profound admiration

Just so much reference is made to Lister's private life as is necessary to complete the whole and to apportion the work to the periods spent in London Edinburgh, and Glasgow respectively The first paper brought before us is that ' On the Early Stages of Inflammation , read before the Royal Society on June 18, 1857, when Lister was just over thirty years old and of this the section dealing with the effects of irritants upon the tissues is printed almost in full

Then follow a paper on 'Anæsthetics ', one of two contributions to *Holmes's System of Surgery* in 1861 and a paper on A New Method of Treating Compound Fractures, Abscesses etc published in *The Lancet* in 1867 The next place is allotted to an account of two demonstrations of antiseptic surgery given to the British Medical Association in 1875 when Lister was Professor of Clinical Surgery at Edinburgh The two concluding papers take the form of addresses one on Fermentation', delivered in King's College, London, in 1877, and the other on The Present Position of Antiseptic Surgery ", delivered before the International Medical Congress, Berlin, in 1890 Each paper is prefaced by valuable explanatory notes by the author, and Sir Rickman Godlee is deserving of the gratitude of the profession for having supplied this ready opportunity of studying at first hand the original records of Lister's monumental work

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Feebleness of Growth and Congenital Dwarfism with special reference to Dysostosis Cleidocranialis By Dr Murk Jansen, O B E , Lecturer on Orthopædic Surgery, Univer sity of Leiden, Holland Large 8vo Pp 82, with 40 illustrations 1921 London Oxford Medical Publications 12s 6d net

Dr Murk Jansen has many claims on the attention of British surgeons He speaks and writes our language fluently , he is a recognized authority on orthopædic surgery during the war our wounded interned in Holland had the benefit of his skill

In 1912 he published in English a monograph on achondroplasia, with many excellent illus trations He was then convinced that this remarkable disturbance of growth could be best explained by supposing the amnion to have exerted an injurious pressure on the embryo at an early stage of its existence In the present work we are glad to note that he concentrates his attention on the very marked alterations which are to be seen in the epiphyseal lines of all cases of achondroplasia In all conditions where there is dwarfism or enfeebled growth, definite departures from the normal are to be found at these zones of bone growth He recognizes that the sexual glands can and do exert an influence on the growing tissues of muscles and bones , but dwarfism and enfeebled growth he regards as being due not to the lack of any hormone or product of internal secretion, but to the presence of some noxious substance in the circulating blood His position may be made clear by the following quotation (p 20) —

The same noxivity, an intestinal catarrh, which will cause death, or prediatrophy or athrepsy in the first year of life, may provoke diaphyseal or epiphyseal rachitis in the following years, muscular weakness—attended by even excess of body height—during adolescence Hence the fact

that the first year of life is characterized by high mortality and by pedatrophy or rhachepsy, whilst the following years successively show a tendency toward diaphyseal rachitis, epiphyseal rachitis, and muscular weakness with excess of height, is explained by the diminishing rapidity of growth of the individual, ie, in view of the law of the vulnerability of fast growing cell groups,"

We fear this explanation takes us no further than informing us that feebleness of growth and ill health are often associated

The second part of Dr Jansen's book is devoted to a restatement of his theory of amniotic pressure as a cause of dwarfism   Amongst the ill effects of amniotic pressure he includes not only cranocleidodysostosis and congenital dislocation of the hip, but also anencephalic foetuses   Now it has been demonstrated over and over again that the condition of anencephaly can be produced by experimental means—hatching eggs at abnormal temperatures, or by exposing embryos to injurious salts or substances   No one has yet shown that abnormal amniotic pressures could produce the results ascribed to them by Dr Jansen

We commend some of the excellent illustrations which the author has reproduced in this work, and congratulate him on the tenacity he has shown, and is showing, in following up the causes of defective growth

History and Bibliography of Anatomic Illustration in its Relation to Anatomic Science and the Graphic Arts   By LUDWIG CHOULANT   Translated and edited with notes and a biography by MORTIMER FRANK, B S, M D   Large 8vo   Pp xxvii + 435 with numerous illustrations   1920   Chicago   The University of Chicago Press $10 net

IN 1852 Dr Ludwig Choulant of Dresden, published his classical work on the *Geschichte und Bibliographie der anatomischen Abbildung*   The book has long been unattainable, and it was a meritorious action, therefore, on the part of Dr Mortimer Frank to translate and issue what is practically a new edition   Dr Frank died in April, 1919, at the early age of 44, and the publication of the book has been entrusted to Dr Fielding H Garrison and Dr Edward C Streeter, who have added a short biography of the translator and have appended two valuable articles, the one dealing with sculpture and painting as modes of anatomical illustration, the other on anatomical illustration during the last sixty years

Choulant rather arbitrarily divided the history of modern anatomical illustration into six periods, the first being before the advent in 1521 of Berengarius da Carpi, the friend of Benvenuto Cellini, the last beginning at 1778, when Antonio Scarpa and von Soemmerring were directing attention to the viscera and the nervous system   Choulant gives a short account of each writer in each of these periods, with a criticism of their artistic work, in many cases with a copy of one of their illustrations and a bibliography of the chief editions of their works   The general conclusion is that the older anatomists devoted themselves almost exclusively to the accurate delineation of the muscles, skeleton and superficial veins and nerves, so that the illustrations were of greater use to the artist than to the surgeon   Indeed, surgeons had very little use for expensive and well illustrated anatomies, which they were usually too poor to buy or too ignorant to desire   Such anatomy as they knew was learnt by compulsory attendance at the public dissections required of them by the particular Company of Barber Surgeons of which they were members

There is still room for improvement in the bibliographical portion of the work—though the translator and the editors have enlarged it to some extent, and have acknowledged and utilized the work of Professor Sudhoff   On page 104 "Count" Arundel should be The Earl of Arundel, the friend of Dr William Harvey, and on page 176 the Greek word 'skeleton' should be in the genitive and not in the nominative as it is printed   On page 177 Vesalius' little play on the Hebrew words has been slurred over with an &c"   They might just as well have been translated   The book is provided with a good index which adds greatly to its value

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Des Andreas Vesalius sechs anatomische Tafeln vom Jahre 1538 in Lichtdruck (The six anatomical plates published by Andrew Vesalius in 1538, reproduced by photo lithography)   Edited by MORIZ HOLL and KARL SUDHOFF   1920   Leipzig   Johann Ambrosius Barth

THESE celebrated plates are issued in a somewhat reduced form   is a memorial of the quater centenary of the birth of Andrew Vesalius, the father of modern anatomy   They are the first fruits of the work of Vesalius and were engraved at Venice by Johannes Stephanus von Calcar, a pupil of Titian   Being fly leaves'—that is to say being issued separately and unbound for the use of artists and others who were studying anatomy—they became so scarce that it was doubtful whether any copies existed   Two sets of plates, however were found, and in 1874 Sir William Sterling Maxwell reproduced his plates in facsimile at his own expense, the issue being limited to thirty copies   The present volume renders them accessible to the general student of anatomy

In addition to the six plates, Professor Sudhoff has added a short historical introduction and Professor Holl, of Graz, has written a description designed by Vesalius and printed by Microhos   There is also a reproduction of the *Nervorum delineatio* which was designed by Vesalius and one of the arterial system   The plates consist of the skeleton, and one of the venous and one of the arterial system   Their value lies in the fact that they show the anatomical knowledge possessed by Vesalius in 1538 as compared with that displayed only five years later, when he issued the first edition of his great work on anatomy *De corporis humani fabrica*   In this short interval he had come under the influence of Leonardo da Vinci and had learnt to observe

RECONSTRUCTION OF THE COMMON BILE-DUCT.

By A J WALTON, London

There are certain cases where the common bile-duct is obstructed or destroyed in which cholecystenterostomy is unwise or impossible These cases present some of the greatest difficulties in surgery, and with the increase of operative treatment upon the gall-bladder and ducts, it is found that they are not so uncommon as was at one time believed They may be grouped under the following headings (1) Accidental injury and removal of a portion of the common duct in performing the operation of cholecystectomy , (2) Injury of the hepatic or common ducts owing to the absence of a cystic duct , (3) Certain cases of early chronic pancreatitis , (4) Certain cases of advanced chronic pancreatitis (5) Combined carcinoma of the gall-bladder and common duct , (6) Some cases of carcinoma of the head of the pancreas , (7) Obstruction of the common bile-duct from scar tissue, either within or without the lumen of the duct

These groups will not all present the same problems , for in the first three the common bile duct is either of normal size or is collapsed, while in the last four it may be considerably dilated

1 Accidental Injury of the Common Duct during Operation of Cholecystectomy —This is much less common than was at one time believed Fowler[4] quotes Kehr as having had sixteen such injuries during one thousand cholecystectomies, and Jacobson has shown that injuries to the common and hepatic ducts are usually the result of operative accidents Probably injury is much more common than one would be led to believe from a study of the literature, for many surgeons are shy of reporting their own errors The conditions which may place the duct in danger are, however, so many that it is probable that there are very few surgeons frequently performing cholecystectomy who have not at some time or other injured the duct In the early days of the operation when it was customary to commence removal of the gall-bladder from the fundus, it was very easy, if there were many adhesions around Hartmann's pouch, to pull up a loop which was formed of the common and hepatic ducts, and to divide this loop right across in the belief that it was a cystic duct Before it was the custom to examine the common bile duct as a routine procedure, it was probably not infrequently ligatured before the cystic duct was divided, and thus the accident was entirely overlooked The case which first directed my attention to this accident was of this nature The patient was returned to bed with no indication that there was any untoward condition , later, the hepatic duct gave way and a fatal peritonitis was produced Even with the more general introduction of removal of the gall-bladder from the cystic duct end, the presence of firm adhesions around the neck of the gall-bladder may lead to a similar complication In the second case in my series the accident was of this nature, but happily the presence of two openings was discerned in the wound and an immediate end-to-end suture was performed with satisfactory results This led me to make the invariable rule that the cystic duct was never to be divided until all three ducts, namely, the hepatic, cystic, and common, were clearly exposed in the operative field In spite of this precaution, accidents may still arise which are more prone to occur owing to some abnormality of the cystic artery Both Mayo[17] and Eliot[3] have laid stress upon the danger of clamping the duct in attempting to pick up the retracted proximal end of a divided cystic artery The danger is much increased if there have been many surrounding inflammatory changes from a chronic cholecystitis, and especially is this so if there is a fistula between the gall-bladder and the intestine, for in this condition the anatomical relationships may be so distorted that the common duct may be injured before its position is realized Owing to the fact

that the gall-bladder has been removed, a cholecystenterostomy is of course impossible As a general rule, however, attempts to explore the common duct will lead to an early recognition of the condition, and an end-to-end anastomosis is then usually performed Even with this operation the results may not be entirely satisfactory, as there is a certain tendency for stenosis to occur at the site of the union If the damage be overlooked, a permanent fistula will result By the time the second operation is undertaken, the lower end of the common duct is often so contracted and collapsed that it cannot be found, and an end-to-end suture then becomes impossible

2 **Injury of the Common and Hepatic Ducts owing to an Absence of the Cystic Duct** —It is of interest to note that the possibility of this condition has been denied Rolleston [22] in commenting on the case reported by Cucknell, states that this was probably an example of absence of the gall-bladder with dilatation and pouching of the upper end of the common duct There has, however, occurred in my series a case in which the patient had a normal gall-bladder situated in the usual position and containing gall stones When the gall-bladder was removed, it was realized that there were left behind two divided hepatic ducts and a divided common duct These were sutured together, and an after dissection of the specimen showed the complete absence of any cystic duct (vide Fig 159) The two hepatic ducts entered the gall-bladder on one side, and the common duct emerged from it on the other In such a condition—which must be very rare—it would seem impossible to avoid division of the attached ducts

3 **Certain Cases of Early Chronic Pancreatitis** —It occasionally happens, as in my first case of reconstruction, that a patient will present the symptoms of colic , that at operation no stones will be found , that the gall-bladder and common duct will not be dilated, but the pancreas may be hard and nodular, and a probe will fail to enter the duodenum Under such conditions a faulty diagnosis is very likely to be made, and the duct regarded as unobstructed If a cholecystenterostomy be not performed, it is probable that the increasing obstruction will be sufficient to cause the opening in the common duct to break down, and to lead to the formation of a permanent biliary fistula At a second operation the lower end of the duct may be so altered that it cannot be isolated, and the upper end will be found open and discharging bile A cholecystenterostomy may be impossible, either because the gall-bladder had been removed at the first operation, or because it has become too shrunken and contracted

4 **Certain Cases of Advanced Chronic Pancreatitis** —It may happen that a patient will present definite symptoms of common bile-duct obstruction, but it is uncertain whether the obstruction is due to gall stones or to the presence of chronic pancreatitis At operation the gall-bladder is found distended It is aspirated as a preliminary to performing a cholecystenterostomy Instead of the thick tenacious bile which is usually found under these conditions a thin white mucoid fluid escapes This at once leads to the suspicion that the cystic duct is obstructed, and that the distention of the gall bladder is due to mucus and not to bile In order to settle the diagnosis an incision may be made into the common bile duct, when the escape of a similar fluid clearly determines that the absence of bile is due to a failure on the part of the liver, and the ducts are distended with a so called white bile The surgeon is now in a difficulty If the common bile duct be sutured and a cholecystenterostomy performed, it is very probable that the wound in the common duct will give way and that a permanent fistula will be formed, so that it will appear safer to attempt to perform a union between the duodenum and the opening in the common bile-duct

5 **Combined Carcinoma of the Gall-bladder and Ducts** —It will sometimes happen that there is a carcinoma of some portion of the common duct together with gall stones and a carcinoma of the gall-bladder Under such conditions it may be impossible, owing to the extent of the disease in the gall bladder, to perform a cholecystenterostomy Moreover, if one growth be situated at the junction of the cystic and common ducts there will be no regurgitation of bile into the gall bladder, and hence an operation of this sort would be of no benefit If the growth be relatively high up, it may be a very difficult matter to perform a direct lateral anastomosis between the duct and the duodenum In those

cases in which the growth is so localized that the surgeon is able to remove the diseased portion of the duct and the gall-bladder, the duct will be left completely divided, and there may often be a very considerable gap, so that an end-to-end suture becomes difficult or impossible The same is true with an uncomplicated carcinoma of the duct, if it be situated so high that during its removal the cystic duct is separated from its junction with the common hepatic duct

6 **Some Cases of Carcinoma of the Head of the Pancreas** —The conditions here will be identical with those occurring with a chronic pancreatitis , but the cases are even less satisfactory, for even if a new duct be made the carcinoma will have to be left *in situ* where it will continue to grow Mayo[17] has laid stress on the unsatisfactory results of this operation Of four cases, two died soon after the operation and the other two lived for less than eighteen months

7 **Obstruction of the Common Bile duct from Scar Tissue, either within or without the Lumen of the Duct** —This condition is rare Occasionally a stone impacted in the duct may ulcerate into the walls, and at the site of ulceration a fibrous stricture may develop This is more prone to happen at the junction of the three ducts, for here the duct is less likely to dilate and overcome the stricture Under these circumstances the gall-bladder is less likely to be distended, so that a cholecystenterostomy becomes impossible or useless, and some form of duct anastomosis or reconstruction will be necessary

The operations which have been undertaken in an attempt to treat the foregoing conditions are many, and may be grouped as follows —

1 **Direct Suture** —This is the operation which is most commonly performed In Jacobson s series there were 21 cases of end-to-end anastomosis combined with drainage of the hepatic duct, and 2 cases of end-to-end anastomosis without drainage of the duct Eliot was able to collect 16 cases of primary suture for injuries and 7 of end-to end suture after resection of the stricture Two methods of operating have been carried out In the one the ducts are directly united, and in the other they are joined around a T-shaped rubber tube It is probable that either of these operations will only be feasible immediately after the duct is divided , that is, where obstruction has been removed or an accidental division has been recognized immediately If a persistent biliary fistula be present, the lower end will generally be so contracted and shrunken that it will be impossible to find It is, moreover, a little doubtful whether the operation of end-to end suture is as ideal as would at first sight appear If no tube is used, there is the possibility that the junction may constrict Of my own two cases (Nos 2 and 3), one remained perfectly well, but the other has since developed attacks of pain and jaundice In Eliot s[3] collected 23 cases there were 4 failures with recurrence of jaundice Suture around a T tube would appear to be unsound theoretically, for it will only be possible for the tube to be removed from the duct by a process of ulceration or tearing of the junction, and hence an irregular opening will be left which is liable to constrict

2 **Lateral Choledochenterostomy** —The formation of an anastomosis between the duct and the duodenum will generally only be possible when the obstruction is low down and when no biliary fistula is present , that is, when the common duct is considerably dilated Under such conditions the operation has not uncommonly been employed, although there has often been considerable difficulty in obtaining accurate apposition of the openings For this reason Horz[11] advocated that the anastomosis should be performed around a rubber tube, the lower end of which is brought out through a second opening in the duodenum and drained externally, the tube being removed on the eighth day Sasse[23] obtained very satisfactory results with choledochenterostomy, and advocated that the operation should be more frequently performed, and even undertaken in cases of obstruction by a calculus, thus allowing freer drainage of the duct My own experience of this operation has not been satisfactory The only case in which I performed it (No 4) was one of chronic pancreatitis together with stones, and, although there was no leakage of bile, the patient collapsed and died four days after the operation In order to make the anastomosis it is necessary to angulate the duct and duodenum so as to bring them

into apposition, and the operation appears to cause undue stress upon the line of junction

3 Re formation of an Absent Common Duct

—When a portion of the common duct is entirely absent an attempt must be made to form a new path along which the bile can enter the intestine Of the many steps that have been taken to produce this result, some appear to day to be fantastic, and must be simply regarded as interesting steps in the development of modern technique They may be considered as follows —

ı *Hepatico-enterostomy* —Here a small portion of the liver was excised so as to leave a raw area, in which the bile-ducts were opened An incision was then made into a loop of the jejunum, and the edges of the incision were sutured to the margin of the liver This operation failed because the bleeding from the edge of the liver was difficult to control, it was difficult or impossible to suture the intestine to the liver, and there was danger of infection spreading from the intestine to the intrahepatic ducts

ıı *Anastomosis between the Fistula and Duodenum* —Operations of this sort were doomed to failure , for not only was it extremely difficult to perform an anastomosis between the edge of the fistula and the intestine, but a faecal fistula was likely to arise, or the walls were almost certain to fibrose and contract so that the path became contracted

ııı *Direct Implantation of the End of the Divided Duct into the Duodenum* —This opera-tion, which was apparently first performed by W J Mayo,[16] is the one most commonly adopted, and the one which would at first sight appear to be the most satisfactory Several cases have now been reported Fowler[4] says that he has had several where the operation was performed after resection of cancer of the duct, and once after partial gastrectomy for cancer of the pylorus the cases for carcinoma were on the whole disappointing He reports another case in which the operation was performed after an accident to the duct, the hepatic duct being implanted in the duodenum around a tube, with very satisfactory results One of Mayo's[17] cases is now reported well ten years after the operation Similar operations have been performed by Packard,[19] Harrington,[10] and White and Lund In Packard s case an ulcer was found occluding the duct at the papilla of Vater The common duct was isolated and cut off from the duodenum It was directly anastomosed to the duodenum, the walls of which were folded over the duct in order that the latter might run an oblique course and hence have a valvular opening Whenever the duct is sufficiently long to allow of it being drawn down, and for the gut wall to be folded over it so as to make a valve, this operation is unquestionably the one of choice Unfortu-nately it not uncommonly happens that it is too short for this purpose So large a portion of it may be destroyed that it cannot even be brought into contact with the duodenum, and much less is there sufficient to allow of a valvular opening The formation of a valvular opening would seem to be essential , otherwise there is grave danger of infec tion spreading from the duodenum and leading to suppurative cholangitis In certain cases the difficulty may be overcome by implanting it into a loop of the jejunum instead of into the duodenum Such a case was reported by Jackson,[1] where an obstruction of the common duct together with a biliary fistula resulted from an operation for carcinoma of the stomach The upper portion of the duct was dissected out and divided , the cut end would not reach the duodenum, and hence a loop of small intestine was brought up to it and sutured to the liver to relieve tension The bile duct was inserted obliquely into it, the anastomosis being made around a rubber tube The small intestine should always be chosen in preference to the colon, for, as Weidemann[27] has shown, a junction between the gall bladder and the colon in dogs is followed by a fatal ascending infection It not uncommonly happens that even this step is not feasible, for it may not be possible to bring a loop of small intestine sufficiently high up without causing kinking of the large or small intestine

ıv *The Use of Autogenous Grafts* —Several attempts have been made to bridge the gap in the common bile-duct by the use of some other tissue Giordano and Stropeni[8] first made use of a portion of vein, and similar experiments were carried out with success in dogs by Gnemto and Luigi[6] In these cases, however, the vein was simply used to bridge the gap between the two ends of the duct, and thus the difficulty of forming a new

valvular opening was not encountered. Mohneus[16] also suggested the use of the appendix but did not perform the operation in the living. Lewis and Davis[14] first advocated the use of transplanted fascia from the abdominal wall, and successfully used this in experiments on dogs. Ginsburg and Speese[7] have since quoted a case in which this method was used in a patient, but here again both ends of the duct were isolated, and the gap was closed with a portion of the posterior rectus fascia sutured around a tube. Leakage occurred, and it was found later that the distal end of the transplant and the tube had broken down. Resuture with reinforcement of the junction by the gastrohepatic omentum was successful.

These operations may have a certain value where both ends of the ducts are isolated, but even then the operation will be associated with considerable technical difficulty, and there will always be some doubt as to whether the graft has taken. When the lower end of the duct is absent they will be of little avail.

\ *Indirect Implantation.*—Most of the modern operations are based upon the method advocated by Sullivan,[21] who inserted a tube into the proximal end of the duct and then implanted the distal end of the tube into the duodenum. The free portion of the tube was then wrapped round with omentum in the hope that a fistulous tract would thereby be formed, and would persist after the tube was passed. A valvular opening into the duodenum was insured by suture of the tube into the duodenum after the manner of the Witzel method of gastrostomy. Fowler[1] states that Sullivan[20] had but a single case which has remained perfectly well for eight years. Brewer[1] reported two cases in one of which death occurred later, apparently from obstruction. Mann[10] also reports a case which was greatly improved five months after the operation, but had not yet passed the tube. Wilms[18] five cases apparently all recovered in the end, but only after very prolonged treatment, more than one operation being necessitated in some of the cases. Fowler[1] performed the operation in one case where obstruction returned three months later, and a similar result occurred in a case of Hagler's,[9] where obstruction appeared seven months later and, post mortem, cholangitis with abscesses in the liver was found. Mayo[17] lays stress upon the fact that stricture is likely to occur ultimately; but if it can be combined with direct union of some portion of the duct, so that there is a partial lining of mucosa this tissue may grow around and ultimately give satisfactory results.

On theoretical grounds the operation would certainly appear to be faulty. The tube being held in non-contractile tissue is unlikely to be passed; the wall of the duct is formed of omentum alone, and thus at best is a fistulous tract; stenosis is therefore very likely to occur and lead to a recurrence of the condition.

The difficulties and drawbacks which are associated with all of the above methods led me to devise an operation, which I first published in 1915,[23] and which I have used in six cases with entire satisfaction.

TECHNIQUE OF OPERATION

Exposure is gained by an upper right pararectal incision. In passing, I may say that I now invariably use this incision for all cases of disease of the stomach, duodenum, and gall-bladder. I find that it gives an admirable approach and a perfect view, so that I have never found it necessary to employ the Kocher, Mayo Robson, or Bevan incisions. Being placed wholly to the inner side of the rectus muscle, it does not interfere with the nerve-supply, and thus can, if necessary, be carried from the costal margin to the pubes without leading to any permanent weakening of the abdominal wall. The common bile-duct is now laid bare; if there has been a prolonged biliary fistula, the lower end will probably not be discovered; if there is a stricture or carcinoma, this is removed, if possible, so that there now remains a condition in which the upper end of the duct is patent, but is separated by a wide gap from the duodenum, making a direct implantation impossible. The upper border of the duodenum is now drawn upwards and sutured, so that the gap is as far as possible reduced. The largest size tube that will enter the cut end of the duct is inserted and sutured in position with plain catgut. A flap is then cut from the anterior surface of

the duodenum, and is turned downwards The upper part of the resulting opening is sutured until it is only sufficiently large to admit the tube The tube is then inserted, and the flap turned upwards over it   In the upper portion the edges of the flap are sutured around
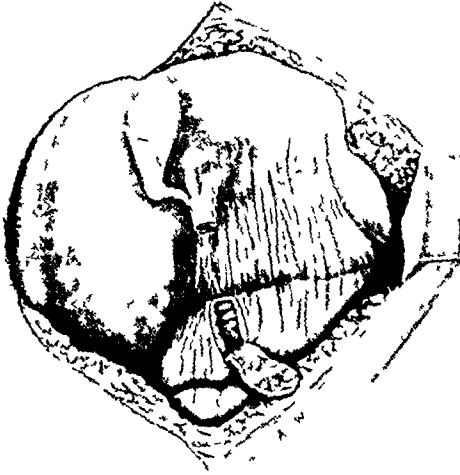
FIG 154 —Showing duct divided and opening made into duodenum
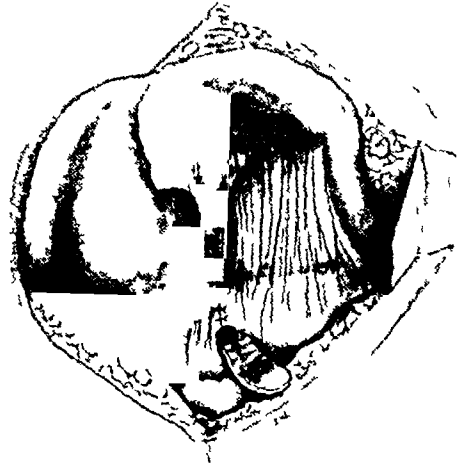
FIG 155 —Tube sutured in duct   Opening in duodenum partly sutured

the tube, and to the edges of the cut duct , below they are sutured to the wall of the duodenum which forms the structure adjacent to the posterior surface of the tube   For safety a small drainage tube is inserted down to the junction
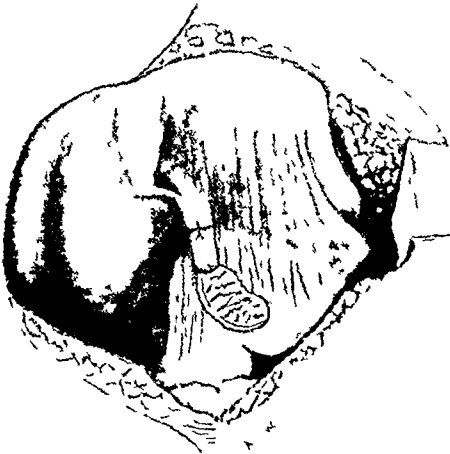
FIG 156 —Tube inserted into duodenum   Duodenum drawn up as close as possible to common duct
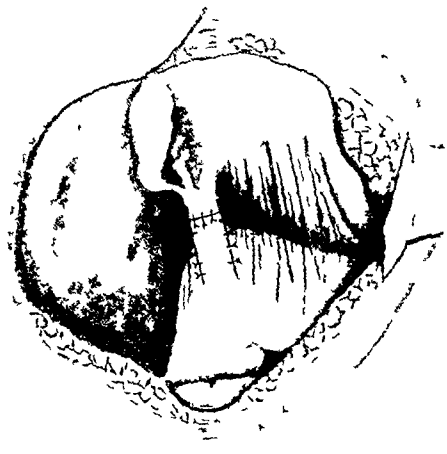
FIG 157 —Duodenal flap sutured around rubber tube

Fig 154–157 are reproduced from ' Surgery Gynecology and Obstetrics Sept 1915 '

The operation in practice is very simple to perform   A new duct can readily be formed of practically any length , it is lined with mucous membrane, which is impervious to the action of the bile, and being lined by such a membrane will show no contraction , the tube

passes obliquely over the duodenal surface, and hence there will be a well-defined valvular action Owing to the presence of the mucous membrane lining it is not necessary for the tube to remain long in position It can be sutured in place with plain catgut, which is dissolved in a few days, and thus there is little or no danger of the tube being retained

Ginsburg and Speese have suggested, as a modification of this operation, that the flap be turned upwards instead of downwards They claim that by this means the suture will be easier, for the flap will lie behind the tube It will also have a better blood-supply This modification, however, does away with the important valvular nature of the opening I tried it in one of my cases, and was not at all satisfied with the technique The flap being turned upwards is angulated at its pedicle and suture in this position becomes much more difficult A comparison of the two operations leaves me strongly in favour of the view that instead of being easier to perform it is more difficult, and the opening into the duodenum is physiologically much less satisfactory I have found the former method so easy and so generally satisfactory that I have made a slight modification of it for use in those cases in which there is an obstruction low down in the duct In the cases already mentioned in which there is an obstruction due to carcinoma or chronic pancreatitis, and in which the duct has been opened for exploratory purposes, so that cholecystenterostomy becomes a risky proce dure, it is a perfectly simple matter to insert the tube into the lateral opening of the common duct instead of into the cut extremity, and then to reconstruct the new duct from the duodenal flap around the tube, so that there is, in fact, a new duct entering the lower part of the original one at a slight angle The results of my own cases are classified in the following three appendices —

Appendix A consists of 4 cases in which an injury was overlooked, or some method other than the reconstruction was performed Of the 3 cases in which some form of repair was carried out, 1 died, and 1 has had some evidence of further obstruction Of the 6 cases in which reconstruction has been performed, the results are on the whole satisfactory

FIG 158 — Acute cholecystitis Accidental removal of portion of common duct (*Appendix A Case 1*)

Appendix B consists of 3 cases in which the new duct was joined to the end of the divided duct One, which had carcinoma of the common duct low down, and also carcinoma of the gall-bladder died after resection of both carcinomata and reconstruction of the duct The other 2, who had benign obstructions, are in perfect health four years and eighteen months respectively after operation It is interesting to note that in one patient the hepatic ducts were both divided, so that two tubes had to be inserted and the flap sutured around them both

Appendix C includes 3 cases where the new duct was united to the side of the common duct One, who had an advanced pancreatitis, died seventeen days after the operation, but the tube had been passed and there was no evidence of leakage The other 2 cases recovered completely from the operation, but since one of these had an incurable carcinoma of the common bile-duct and the other an advanced chronic pancreatitis, they are not free from symptoms Thus, of 6 cases there are 4 recoveries and 2 deaths

CLASSIFIED CASES

Appendix A —Cases Treated other than by Reconstruction Method

Case 1 —Acute cholecystitis   Accidental division of common duct overlooked   Death

M J C   Patient, age 53   History of gall stones many years

Acute cholecystitis   Cholecystectomy, Feb 25, 1913, commencing it cystic duct   Common duct accidentally overlooked and ligatured   Onset of peritonitis three days later

Second operation —Drainage of peritoneum   Died

Post mortem —Division of common duct ligatured on both ends   Leakage from upper end   Peritonitis   Dissection of specimen revealed the presence of about one inch of common duct (*Fig* 158)

Case 2 —Accidental division of common duct   End to end suture   Recovery

M W   Patient, age 40   Gall stones accidentally discovered by gynæcologist during operation for fibroids

Cholecystectomy, Oct 15, 1915, commencing it cystic duct   Accidental division of common hepatic and common bile ducts   Immediate suture   Slight leakage of bile for nine days   Complete recovery
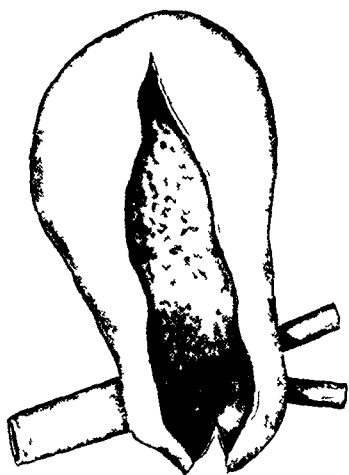
Case 3 —Congenital absence of cystic duct   Division of hepatic and common ducts   End-to end suture   In complete recovery

L H   Patient, age 38   History of gall stones five years

Cholecystectomy, June 2, 1916   After removal, two hepatic ducts and common bile duct found to be divided   Immediate end to end suture

Dissection of specimen revealed two hepatic ducts entering one side of gall bladder, and common duct emerging from the other (*Fig* 159)   Slight leakage of bile two and a half weeks   Passage of bile to intestine   Complete operative recovery

Last note, Oct 18, 1920   Keeping very well but every few months has attacks of collapse, with a little pain, followed by profuse jaundice   Attacks last about two days, but are becoming less frequent, hence further operation not advised

Case 4 —Gall-stones   Chronic pancreatitis   Choledochoduodenostomy   Death

S W   Patient, age 65   Ten weeks history of pain and jaundice

Operation Jan 28, 1920   Gall bladder distended, many adhesions, many calculi   Three calculi in common bile duct   Much dilated   Large mass in region of head of pancreas   Opening in side of common bile duct directly anastomosed to opening in side of duodenum   Good progress for three days   Collapsed and died

Fig 159 —Congenital absence of cystic duct   Two hepatic ducts entering the side of gall bladder   Common duct emerging from opposite side

These cases may be tabulated thus —

	TOTAL	DIED	IMPROVED	RECOVERED
Overlooked division of duct	1	1	–	–
End to end suture after division	2	–	1	1
Lateral anastomosis for obstruction	1	1	–	–
	4	2	1	1

Appendix B —Cases Treated by Reconstruction Method   New Duct joined to End or Divided Duct

Case 1 —Early chronic pancreatitis   Exploration of duct   Permanent biliary fistula   Reconstruction of duct   Recovery

J L   Patient, age 27   Eight years history of pain and jaundice   Vomiting

Operation, May 13, 1914   Gall bladder not dilated   Common duct not dilated   Head of pancreas hard and nodular   Common duct explored   Passage not free   Sutured   Gall bladder

drained (It would have been better to have performed cholecystenterostomy) Developed permanent biliary fistula
Second operation, June 3, 1914 Reconstruction of common bile duct by flap method Complete recovery with no leakage Passed tube on 11th day
Last note, Sept 11, 1918 Perfectly well, except for occasional slight attacks of abdominal pain Has served in the army through war Fighting in Gallipoli, April to December, 1915

Case 2 —Cholelithiasis Acute cholecystitis Cholecystectomy Exploration of common duct Stricture of common duct Biliary fistula Reconstruction of common duct Recovery

S L Patient, age 64 History of gall stones several years Severe pain twelve days
Operation, Aug 11, 1919 Gangrenous cholecystitis Cholecystectomy Stone in stump of cystic duct Removed Duct sutured Developed permanent biliary fistula
Second operation, Oct 1, 1919 Opening found at junction of two hepatic ducts, stricture just below Two hepatic ducts divided Tube inserted into each Flap made from duodenum and sutured around tubes Uninterrupted recovery Tubes passed on 11th and 15th day
Last note, Feb 4 1921 Complete recovery No pain, full diet, never any symptoms since operation

Case 3 —Cholelithiasis Carcinoma of gall bladder Carcinoma of common bile duct Cholecystectomy Reconstruction of common duct Death

J U Patient, age 60 Thirty years' history of gall-stones Constant jaundice ten weeks
Operation, Jan 19, 1921 Cholelithiasis Carcinoma of gall-bladder Cholecystectomy Dilatation of common bile duct Carcinoma of common bile duct just above duodenum Growth resected Tube inserted into upper end of common duct Reconstruction of flap Died four days later

These cases may be tabulated thus —

	TOTAL	DIED	IMPROVED	RECOVERED
Chronic pancreatitis	1	–	–	1
Stricture of common duct	1	–	–	1
Carcinoma of duct and gall bladder	1	1	–	–
	3	1	0	2

Appendix C —CASES TREATED BY RECONSTRUCTION METHOD NEW DUCT JOINED TO SIDE OF COMMON BILE-DUCT

Case 1 —Chronic cholecystitis Advanced chronic pancreatitis New duct joined to side of common bile duct Death

W E Patient, age 48 Six months' history of pain and jaundice
Operation, Aug 1, 1917 Gall bladder small and shrunken Adherent to colon Common duct dilated Head of pancreas hard and enlarged Cholecystectomy Opening made in side of dilated common duct Tube inserted and sutured Flap of duodenum sutured around tube Wound healed Passed tube on 9th day Gradually sank, and died seventeen days later

Case 2 —Cholelithiasis Cholecystitis Carcinoma at junction of ducts New duct joined to side of hepatic duct Recovery

A M —Patient, age 48 History of stones many years Persistent jaundice 6 weeks
Operation, Sept 24, 1919 Liver enlarged Gall bladder distended Full of stones and mucus Growth at junction of hepatic, cystic and common bile ducts Hepatic duct much dilated Growth adherent to structures around preventing removal Opening made in hepatic duct Tube inserted Modification of flap operation is suggested by Ginsburg and Speese performed (This was not so satisfactory as the usual operation The opening was not valvular, and it was more difficult to obtain accurate suture)
Cholecystenterostomy then performed to allow of drainage of gall-bladder and cystic duct secretion Primary union Complete disappearance of jaundice in four weeks
Last note, Feb 6, 1920 No jaundice Subject to attacks of pain and vomiting Wasted Great muscular weakness, probably progression of carcinoma

Case 3 —Carcinoma of head of pancreas or chronic pancreatitis Failure of secretion of bile Exploration of common bile-duct New duct joined to side of common duct Recovery

J M Patient, age 62 Persistent jaundice three months
Operation, Oct 6, 1920 Gall bladder distended, no stones Contained mucoid material suggesting cystic duct obstruction Common duct explored Similar mucoid fluid Hard mass

in region of head of pancreas   Tube inserted into opening made in common duct   Flap of duodenum sutured around tube   Gall bladder sutured   Vomit contained bile second day after operation   Ten days later, stools coloured   No leakage of bile   Wound healed   Tube passed on 14th day

Last note, April 14, 1921   No further jaundice   Weak   Considerable flatulence   Some attacks of pain much relieved by taking pancreatic extract

These cases may be tabulated thus —

	TOTAL	DIED	IMPROVED	RECOVERED
Chronic pancreatitis	2	1	1	—
Carcinoma of duct	1	—	1	—
	3	1	2	0

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STUDY OF SOME METHODS OF BONE-GRAFTING

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IN the following article no attempt is made to settle finally the vexed question as to which method of dealing with ununited fractures is the best, because the number of cases at the author s disposal is not sufficient to warrant dogmatic statements , moreover, it is probable that in this, as in other branches of surgery, each method has its own special indications, nor is any one adapted to all cases   It is hoped that a study of the following groups of cases treated by various methods may be helpful in illustrating the advantages and limitations of the different types of operation

The cases recorded were all sooner or later in wards under the writer s care, with the exception of two, which are published by kind permission of Sir Harold Stiles, as they illustrate well the fate of grafts in the form of bone-chips   Owing to various administrative changes, most of the cases had been operated on at least once before coming under the writer's care, while some of the later ones were operated on by her assistants, but no cases are recorded whose progress had not been personally followed

They have been chosen not as typical of the work at Bangour, but to illustrate special difficulties which confront the surgeon who deals with non-union following septic fractures, and the drawbacks and advantages of the various methods available   For this reason a large proportion are cases where several attempts had to be made before a successful result was attained, and in a few it was not attained while the patient was still in the hospital   In the writer's experience, it is by his failures that a surgeon and his friends learn most, and one failure is often more instructive than half a dozen successes , mere tables of good results are of little value to the student, however desirable from the patient s point of view   The surgeon who approaches a new field wishes to know the possible pitfalls, and unfortunately in bone-work they are many

The guiding principles in all these cases seem to be —

1 Wide opening-up of vascular bone, so as to give as many osteophytes as possible access to the seat of fracture

2 The preliminary counteraction of all deforming tendencies, which are usually due to the simultaneous involvement of the soft parts

3 The protection of the bone from undue stress subsequent to the operation   This is attained best, in the writer s view, by the application of a plaster-of-Paris cast at the time of operation, which eliminates the risk of slipping of the support, or interference with the position by patient or nursing staff   It enables the patient to get about freely at an early period, even with lower-limb injuries   It exerts an even pressure, and so interferes but little with nutrition of the parts and the shape of the muscles

4 As soon as the ends of the bone are tied together by soft callus, so that they cannot get separated by soft parts, stimulation of the bone by local heavy massage and use of the limb in a support which will prevent deformity

The operative methods available for dealing with an ununited fracture, which has no chance of spontaneous union owing to the intervention between the bone-ends of some other tissue, are —

1 *Raising the ends,* preferably with stepping, so as to secure some mechanical safeguard against separation of the ends and to increase the surface of contact   This usually needs to be reinforced by the use of some form of ligature, either wire or strong catgut, which is best passed through holes drilled in the bone ends

2 The use of numerous *small bone-grafts,* as sources of osteoblasts, to supplement the osteogenetic powers of the bone-ends   These chips of bone may be derived from the

neighbourhood of the fracture, or from some other bone, the iliac crest being the best source of vascular cancellous bone

3 *A sliding graft*, i e , a slice of bone from the surface of one fragment, which is slid across the gap and brought in contact with a specially-sawed area on the surface of the other fragment

4 An *intramedullary peg-graft*, usually derived from some other bone

5 An *inlay graft* from some other bone, usually the tibia, which provides a considerable length of dense bone adapted for this form of 'internal splint

6 *Plating* This method provides an internal splint of great mechanical strength, but of a substance foreign to the organism, and therefore liable to cause irritation, and possibly to be ultimately extruded

7 *Grafts of ivory* or *boiled bone*, either human or animal, which may be used either as intramedullary or lateral grafts

THE TWO-STAGE OPERATION

We will deal in turn with each method, referring to its special advantages and drawbacks, and illustrating these as far as possible by case records , but before discussing the first method, the writer wishes to draw attention to the great benefits of what may be called the *two stage operation* in dealing with ununited fractures, more especially those due to war injuries By this is meant the use of a preliminary operation at which as much scar tissue as possible is excised, particularly that over the bone-ends, including the sclerosed portions of bone, while all contractures and other static deformities are overcome, often with the assistance of a plaster cast to maintain correction If primary healing occurs, a second operation, at which the actual graft is introduced, is done two weeks later The advantages of this are two-fold —

a It prevents mechanical strain on the bone graft, which, when of more than slight degree, is a fruitful source of non-union This strain is usually due to the anchoring effect of scar tissue, or to shortening of the muscles, which has been allowed to occur while the fracture was ununited Unless the scar tissue has been freely excised and the muscles have been stretched by a plaster splint, the bone-graft is not able to resist them, no matter what mechanical means, in the form of carpentry or wire ligatures, are adopted to reinforce it Though wire does not itself yield early, yet it cuts through the bone is if that were cheese, and therefore fails to maintain its support Indeed, the writer has found that wherever the strain is greater than can be borne by thick iodine-tannic catgut, then, if wire is used, the bone will be cut This is a serious drawback to the use of wire, because, as it is usually applied one inch or more from the end of the bone, it isolates that length from its blood-supply and by so much *lengthens* the gap to be bridged at a subsequent operation As wire has the additional disadvantage
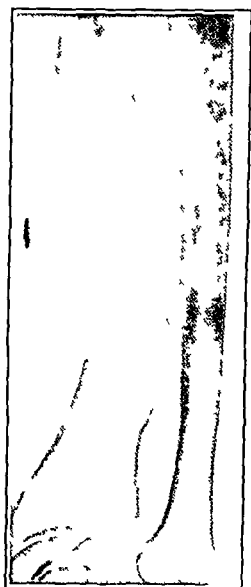
FIG 160 —Pte S
Ununited radius with much radial deviation of hand Before operation
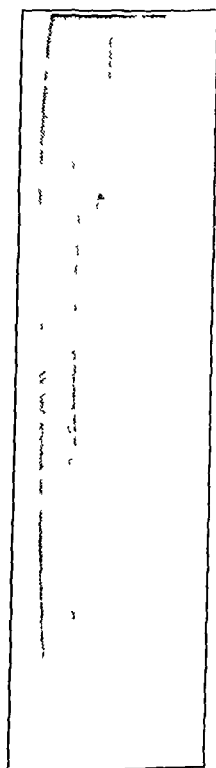
FIG 161 —Same case
(Fig 160 after second operation (lateral tibial raft into radius)

of being a foreign body, liable in itself to cause rarefaction of bone and irritation, and certain to prolong any flare-up of the original sepsis, there seems no reason for its use

b The second advantage of the two-stage operation lies in its connection with the *prevention of flares-up of sepsis*   The organisms to which these are due lurk in the scar tissue, especially that part which has invaded the ends of the bone, and therefore, the more radically the scar is excised, the fewer of these organisms are left   As it is usually impossible to resect the scar without cutting into it, it follows that a few organisms are likely to be set free, and if at the same time a piece of isolated tissue like a graft is left with them it may form a pabulum for them, so that an infection will result, which otherwise could have been stamped out by the vascular tissues of the neighbourhood   Secondly, the dissection necessary to freshen the ends of the bone satisfactorily, with the inevitable opening up of scar tissue, makes complete hæmostasis difficult , whereas this is not so at the second operation, when the bone can be exposed with little disturbance of surrounding tissues   the occurrence of a hæmatoma seriously imperils the success of a graft operation

If a flare-up occurs after the preliminary excision of scar, the surgeon has good warning that the time is not ripe for grafting, while the infection usually pursues a mild course, there being no interference with drainage and no foreign material to keep it up   In such a case it is difficult to know when it will be safe to put in a graft   If there is sufficient skin available to allow of a second excision after a period of heavy massage has failed to evoke a flare, the graft may safely be proceeded with Fortunately, few such cases occur , and it is probable that heavy massage to the bone ends, by inducing a repeated mild auto-inoculation, would enable the patient to destroy the remaining infectious organisms, especially as their original lurking-place, the heavy bed of scar, which had been slowly formed in the original virulent infection, has been removed

FIG 163 —Same as FIG 162 after second operation (lateral tibial graft into ulna)

b 1 As a post-operative infection is generally fatal to the vitality of part or all of the graft, and is the commonest cause of non-union after grafting, it is most desirable to avoid it , and it is well worth the patient's while to undergo the moderate discomfort of a second anæsthetic, especially as this procedure shortens the length of the second operation, which otherwise is apt to be tedious

Most surgeons who have had to deal with the late effects of war injuries have drawn attention to the impossibility of judging by ordinary methods when the original infection is extinct, and not merely quiescent, no known time-limit being in itself a guarantee

The writer has not met a case where this procedure was adopted and where a flare-up occurred after the grafting, and it was more particularly used in cases with a history of severe and prolonged sepsis, or where a previous grafting operation had been spoiled by infection , this speaks strongly for the procedure, even on a small series of cases

The following two cases illustrate the points raised above —

Case 1 —Pte S , age 34   (*Figs* 160 and 161)
April 9, 1918   Gunshot wound with gap fracture of radius   *Aug* 19   First bone graft operation at previous hospital   Suppuration for seven months   Sequestrum removed   *June* 19 1919   Admitted to Bangour   *Aug* 27   Excision of scar—correction of deformity both pronation and radial deviation—plaster cast   *Oct*   Bone grafting, large tibial graft applied to rawed posterior surface of radius, tied by tannic catgut   Plaster dressing   Primary healing Good function finally, but only after several tendon transplantation operations

Case 2 —Pnsr B , age 25   (*Figs* 162 and 163)
Aug , 1918   Wounded   *Dec*   Healed   *June*, 1919   First bone graft operation, followed by flare up   *Jan* , 1921   Admitted to Bangour with severe scarring and ununited fracture of the ulna   Graft had united to the lower fragment   Excision of scar and trimming of bones   Graft from tibia, 5 in long, to surface of ulna, and another 1 in long, between its ends   Plaster case in which a window was cut three days later   Primary healing, and bony union in due course

There is no doubt that the method of applying a strong lateral graft to act as an internal splint, and then using other fragments, which require no stability but only a large raw surface, to fill the space between the actual ends of the bone, gives excellent results In the case of a large bone like the humerus, it is often useful to put the central graft into the medulla of one or both fragments, to prevent its displacement, which is more apt to occur where there is not a second bone acting as a splint, as there is in the forearm

Method 1 —STEPPING BONE

The method of sawing the ends of the bone and stepping them so that the raw surfaces fit together in an L-shaped manner is obviously inapplicable to a single bone in the fore arm or leg, where the second bone splints it and keeps the ends apart   It can be used in such a case if the second bone is divided and stepped also, and this is a desirable pro cedure in a certain type of forearm injury, which will be discussed later   Stepping is particularly applicable to ununited fractures of the humerus, for the inevitable shortening is not a serious disability, unless it reaches extreme limits   In the case of the femur, shortening beyond 2 inches is a serious handicap, so that the method is only applicable to certain cases

The great advantage of this method is that it can be utilized in the presence of infection, e g , during the removal of sequestra, so that by the time healing has occurred union is also firm, and the patient is saved the long waiting period which otherwise would be necessary before any grafting operation was safe   In the arm, the cases where non union occurs usually have scar tissue through its whole thickness, involving the main vessels and nerves, so that the radical excision advised above can seldom be carried out It is therefore usually wise, when removing the scar or sequestra, to freshen and step the ends of the humerus without stripping periosteum more than possible, and then to ligature the ends with strong catgut, which serves to hold them together while a plaster cast is applied, but comes away quickly if there is suppuration   If the cast is strongly reinforced in the axilla, large windows can be cut for the dressing, or indeed a whole lid, so that sepsis is no bar to its application   On the contrary, the rest which it offers by fixation is a most valuable factor in promoting healing

The following cases illustrate the advantages of this method   They had all active or recent sepsis, and it is almost certain that other methods, such as grafting or plating, would have failed to secure union, and would assuredly have resulted in much more severe suppuration

In connection with the subject of stepping bones, it may be well to say a word as to the advisability of shortening one bone of the forearm where the other is ununited   The dangers of this procedure are   (1) Non-union may result in the second bone, especially as the fragments are difficult to control when both bones are loose   (2) The second bone may become infected if a flare-up occurs   (3) There may be slack in the muscles which might interfere with their function   This last is a purely theoretical objection, as the

muscles adapt themselves with extraordinary rapidity, but the two former ones are real and grave   They can be guarded against largely by shortening the healthy bone as a separate operation through an incision planned to avoid scar tissue, unfortunately, if the fractured bone is not exposed at the same time, it is usually impossible to get sufficient overlap of its fragments to allow of subsequent apposition after trimming, however, it is often sufficiently useful to reduce the gap between the ends without actually annihilating it

There is one great indication for shortening the forearm which, in the writer's opinion, can be satisfactorily dealt with in no other way, namely, contracture of the radial tendons, and loss of skin and soft parts in cases of ununited radius, to such an extent that the skin would not meet over a bone-graft, while correction of the extreme radial deviation of the hand would not be possible   In such cases some surgeons lengthen the tendons, which are stretched like a bow-string across the defect in the bone, but as the sutured tendons and the graft lie under a wide skin scar, adhesions are almost certain to impair their function, even if the skin does not actually slough away over them   On the other hand if the ulna be shortened, the skin on the radial side will be so much relaxed that it is usually possible to excise the scar altogether, while the tendons attain a normal tension It is extraordinary what good function the tendons have in some of these cases where they run through a mass of scar, so long as their sheaths are not opened by the surgeon   Non-union of the ulna only is very rarely an indication for shortening the radius

In the case of the leg, the shortening is usually undesirable, but occasionally, with a septic ununited fracture of the tibia with malposition of the fragments, it may be wise to divide the fibula obliquely, so as to let it shorten, in order to get the fragments of tibia into line and contact, if spontaneous union does not then occur, it will be much easier to get satisfactory union later by a sliding graft than if the ends were separated by much scar and were lying at an angle to one another   Case 3, recorded below, illustrates the advantage of this method   The following are cases where shortening of the ulna seemed advisable and gave a good result   In Case 5, the shortening allowed a contracture of the flexors of the wrist to be overcome, and the median nerve to be sutured across a gap, without reproducing the contracture by the need of flexing the wrist, which would otherwise have occurred
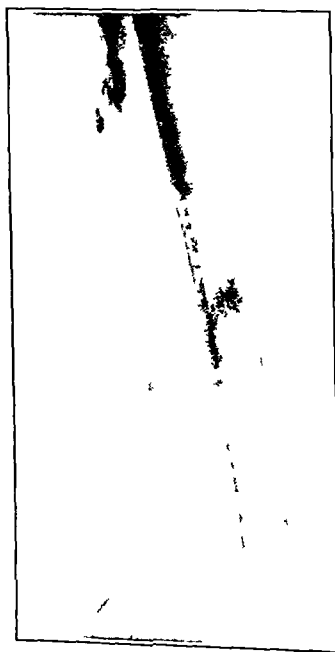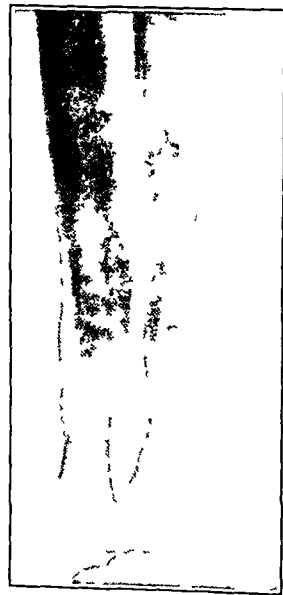
FIG 165 —The same patient as Fig 164 after operation Ulna shortened   sliding graft of radius   (The figure has been reversed in photographing)

CASES WHERE FOREARM WAS SHORTENED FOR UNUNITED FRACTURE OF RADIUS

Case 3 —Sgt C, age 28   (Figs 164, 165)
March, 1918   Wounded, gap fracture of left radius   May   Wound healed   July   Admitted to Bangour, with 1 in gap in left radius and much deviation of hand   Sept   Ulna shortened and united by step and autogenous bone peg   Ulna united, but radius did not   March, 1919   Radius

exposed, sclerosed bone removed, leaving gap of 1 in , 1 4 in sliding graft taken from upper fragment and laid across gap, whilst piece cut to make trough in lower fragment was placed in the gap   June   Union fair   Ultimate result excellent

Case 4 —Rfm G , age 30   (Figs 166 167)
1919   Wounded   July, 1919   Admitted   Muscle contraction of fingers, radius had a 2¼ in gap with extreme deviation of hand   Oct   Excision of wound scar   Jan , 1920   Ulna shortened by 2¼ in , with shortening of extensor ulnaris tendon   June   Bone graft from tibia to radius, which on account of sclerosed ends had not united   Plaster worn for ten weeks, at end of which radius was firmly united with hand in good position

Ic 166 — Rfm G   Un united radius   extreme devia tion of hand—before operation

The radius practically never unites unless it is exposed and freshened at the same time that the ulna is shortened   This procedure is, in the writer s opinion, seldom justifiable, on account of the risk of infecting the ulna from scar tissue, and also because the fragments are much more difficult to control when both bones are quite free, for although the radius is always ununited yet its ends are much steadied by the scar tissue, and it forms a fulcrum in dealing with the ulna

Case 5 —Pte N   (Figs 168, 169, 170)
August,   1917   Wounded
March, 1918   Admitted, the skin wound having just healed Gap fracture of radius with fixed pronation and extreme radial deviation, median paralysis, contracture of wrist and fingers in flexion   March   Ulna shortened by 1½ in over in autogenous intramedullary peg   Supination attained later by a series of plasters   July   Median nerve sutured   Sept   Radius still ununited, ends refreshed, and sliding graft brought across the gap   Union unsatisfactory, so that radius became ingulated Feb , 1921   Useful function, but x rays indicated a false joint in the radius   This occurred because the sliding graft used was too small to stand the strain   Nerve recovered completely

Ic 1C7 —Same case as Fig 166 after operation   Lower end of ulna removed tibial graft

The following case is instructive as showing the danger involved in shortening the forearm , it also illustrates one of the disadvantages of wires, but shows that a good result can be attained in the most difficult case, if surgeon and patient do not allow them selves to be discouraged by a previous failure

Case 6 —Pte Mc G , age 35   (Figs 171 and 172)
Oct , 1917   Wounded   Healed six months later   Oct , 1917   Admitted, gap fracture of radius with septic wound leading down to it   Jan , 1918   Sequestra removed, healed in ten weeks May   Ulna shortened by ¾ in and fixed by medullary peg   Ulna did not unite because the peg slipped out of place   Oct   Ends of radius freshened and tied with tendon sutures   Union did not occur   Feb , 1919   Radius united by step cut operation, primary healing, but non union   May Both bones exposed, stepped, and wired   Plaster   July   Inlay graft from tibia to radius, which was tied in place by wire   Non union of graft at upper end   Dec   Wires removed, ends of bone refreshed , plaster   Feeble union   Feb , 1920   Ulna treated by a sliding graft   July Both bones firmly united

The interesting points about this case are —
1 That the methods of fixation which are commonly supposed to give mechanical stability failed to do so, but did interfere with callus formation

FIG 168—Pte X Ununited radius much deviation and contractures—before operation

FIG 169—Same case as Fig 168 after first operation Ulna shortened, intramedullary peg
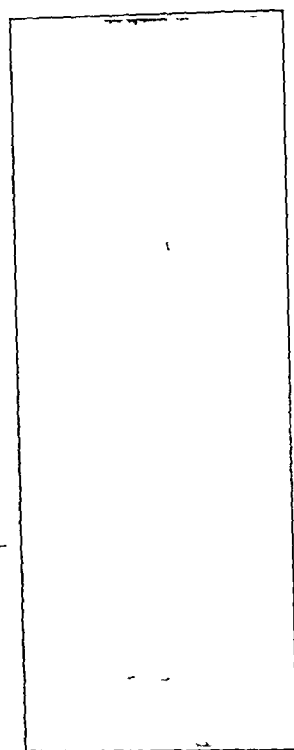
FIG 170—Same as Fig 168 after second operation Small sliding graft of radius
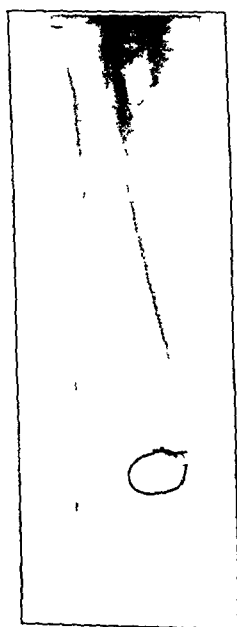
FIG 171—Pte McG after tibial graft of radius Wire and necrosed upper end of tibial graft have been removed, wire of first operation still on ulna
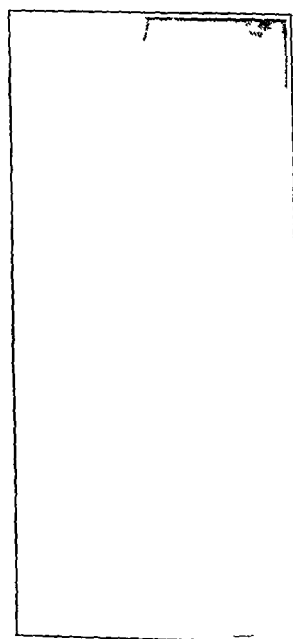
FIG 172—Same case as Fig 171 later Radius now united sliding graft of ulna uniting well Note increase of callus on radius since removal of wire

2 That union was finally attained by very simple methods when the bones were extensively rawed, and fixed just enough to prevent displacement till a cast was applied there was then no interference at all for four weeks, after which a second cast was most carefully applied and worn another four weeks In these cases, where some factor has prevented primary union of a fracture, it seems to take about eight weeks for any union to stand strain , in other words, the rules which can be applied to most simple fractures do not hold with these cases

STEPPING FOR UNUNITED FRACTURE OF HUMERUS

Case 7 —Pte N , age 28

May, 1918   Wounded   *Sept*   Admitted   Septic wound leading down to comminuted fracture of humerus   Ulnar paralysis   Arm in straight Thomas splint   *Oct*   Removal of small sequestra, large fragments with periosteal attachments left in place   *Dec*   Further sequestra removed , arm and chest put up in plaster, with windows for dressings   *April*, 1919   Fracture exposed , further *sequestrum and much scar tissue removed from between the frag ments   Fragments shaped like steps and united by wire, which had subsequently to be removed*   In attempting to flex the elbow, the olecranon was fractured   *July*   Fracture united   Ulnar nerve sutured

Case 8 —Pte J

Ununited comminuted fracture of lower end of right humerus with fixed elbow   Step cut operation, the fragments being tied together with tendon su tures   Some sequestra were removed   The elbow was forcibly straightened and the hand supinated, whilst the lower humeral fragment was held in a lion forceps   Put up in plaster case which inclu ded the chest and forearm Plaster removed in six weeks   After ten weeks the fracture was firm and the elbow had a range from 90° to 130°   Rota tion of hand for about half a circle
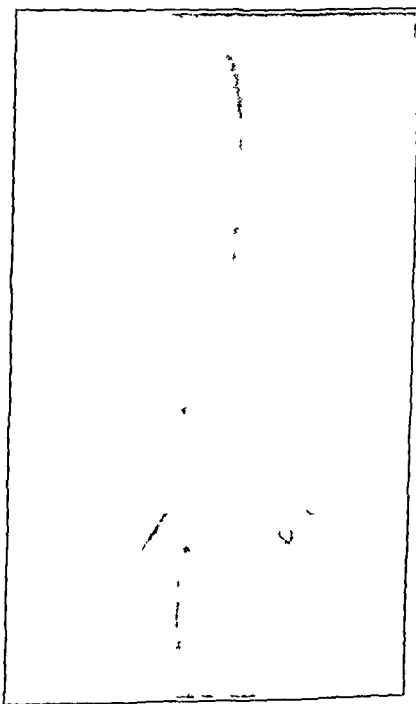
Case 9 — Cpl R (*Fig* 173)

Septic   comminuted fracture   of   middle   of humerus   *May*, 1920 Step - cut operation on humerus with removal of sequestra , some pus was present   Fragments drilled and tied with tannic catgut   *Sept*   Humerus well united   Sequestrum removed   *Oct*   Tendon trans plantation for musculospiral paralysis

Fig 173 —Cpl R After operation   Humerus stepped united

In this, as in the other cases quoted above, any attempt to restore the normal length of the limb by grafting would have meant an indefinite postponement of recovery, while waiting for the sepsis to subside , or, if attempted early, would almost certainly have been doomed to failure

Fig 174 —Lte M After operation   Humeru stepped united

The following case illustrates the failure of plating before the sepsis was quiescent while stepping gave union under the same conditions   Incidentally, the reaction caused by the plating induced a paralysis of the musculospiral, which cleared up after union had occurred

Case 10 —Pte M , age 22   (*Fig* 17)

May, 1918   Wounded   *June*   Fragments of bone removed from humerus   *Feb* , 1919
Further sequestra removed   *April*   Humerus plated, wound left open and treated by Carrel-
Dakin method   Musculospiral paralysis appeared   *Aug*   Plate removed because the wound had
not healed   *Feb* , 1920   Step cut operation with catgut fixation   Plaster cast including chest
and forearm   Slow after progress with removal of sequestra   Gradual improvement of musculo
spiral paralysis   *Feb* , 1921   Union
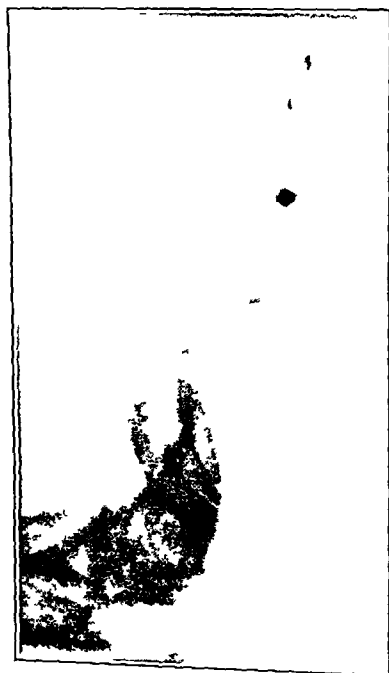
FIG 175 —Pte P   Ununited humerus
before operation

FIG 176 —Same case as *Fig* 175, after
operation   Humerus stepped   united
some bowing, but good function

Case 11 —Pte P   (*Figs*
175, 176, and 177)

This fifth case showed
a similar course, except that
the sepsis was less active
and union occurred much
earlier

The skiagrams show that
there was some forward bow-
ing after union, but this gave
no disability   In this case
there was no interference
with the forearm branches
of the musculospiral, but
those to the outer and inner
heads of the triceps had been
destroyed, with the corres-
ponding segment of humerus
by the bullet   the long head
worked, but this loss and
adhesions of the biceps inter-
fered somewhat with the
function of the limb

This illustrates a point
which should never be lost
sight of in these cases of

FIG 177 —Same case as *Fig* 175   Photograph to show amount of shortening

ununited fracture, namely, that the injury severe enough to cause non-union has usually done irreparable damage to other structures besides the bone and the repair of the latter alone is seldom sufficient to restore usefulness to the limb

The sixth case of this series failed to get union by the stepping operation, but sufficient stability and shortening were obtained to enable the musculospiral nerve to be sutured easily A bone-graft operation was intended to be done when the sepsis was likely to be quiescent, but the man has failed to return for this so far

Case 12 —Pte C R , age 28
Sept , 1918 Wounded Fracture of humerus, with musculospiral paralysis July, 1919 Removal of sequestra Distal fragment impacted into proximal, and tied by tendon sutures These slipped whilst plaster was being applied Oct Step cut operation , ends of bone drilled and tied together Non union persisted May, 1920 Musculospiral nerve sutured July Patient transferred and lost sight of

SHORTENING TIBIA

The following case shows that the method of shortening and stepping a bone may occasionally be applicable to the bones of the lower limb, though the serious disability entailed by much shortening usually contra-indicates it there In a case like the following, where the presence of deep sequestra necessitated an extensive operation, while the sepsis would delay any grafting operation, the other procedure is valuable, as well as much speedier

Case 13 —Pte C , age 20 (Figs 178, 179)
Sept , 1918 Wounded, comminuted fracture of tibia and fibula Oct Admitted, open gap fracture of tibia with overlapping fracture of fibula Plaster case from groin to toes June, 1919 Union of fibula divided and fragments allowed to overlap further Tibia cleaned, lower end impacted into upper Nov Allowed to walk with leg iron July, 1920 Wound healed can walk without support Shortening of 1¼ in

In the above case, the extensive destruction of soft parts over the site of fracture, and the virulence of the sepsis, would have jeopardized the vitality of any graft

The case also illustrates the advantages of the ambulatory treatment of such injuries in plaster, for from the moment the cast was
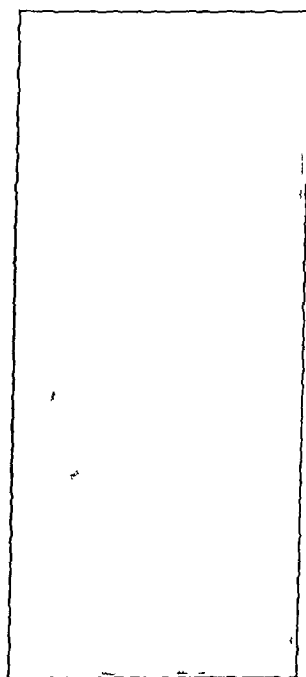
Fig 178 —Pte C Ununited tibia, before operation
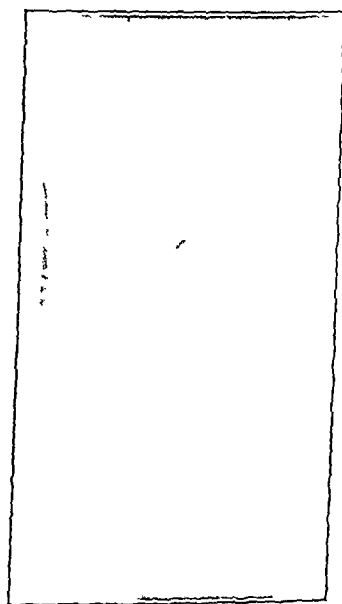
Fig 179 —Same case as Fig 178 after operation Pointed lower fragment of tibia wedged into cavity in upper end after freeing fibula union

applied the daily dressing became painless , the man was able to benefit by fresh air and bodily exercise and social intercourse , and the nursing of the case was reduced to a minimum, which was an important consideration in those days of overworked staff In fact, although the man had a most tedious and disabling lesion, yet he was able almost to lead the life of a normal individual

Method 2 —SMALL   BONE-GRAFTS

The following cases illustrate the value and limitations of the use of small chips of bone from the iliac crest, sown between the bone ends to fill in a gap   The advocates of this method point out that it gives the maximum of raw bone surfaces, and therefore presumably, the maximum escape of living osteoblasts, on whose activity the success of all bone grafting operations depends , moreover the bone used is of a very vascular type The opponents of the method point out that it provides no primary mechanical stability as does the intramedullary peg, and they assert that these small fragments become isolated and tend to absorb after a time, even if at first they increase in size by new growth of bone   The following cases show that they may survive for periods of one or two years, and during that time produce a great improvement in the limb, which one can scarcely believe will be lost later   In the cases quoted, the grafts formed considerable masses of bone, but did not cause bony union of the shafts between whose fragments they were placed   This suggests that the mean view is the just one in this as in most controversies, so that while these grafts have their value as a source of new bone, yet they need to be supplemented by the addition of an inlay or peg graft, if a bony ankylosis is desired   These iliac grafts are indicated for large gaps in thick bones, for which a bridging graft of equal diameter cannot be obtained, and also to replace the enlarged end of a bone, where a joint is flail from its destruction
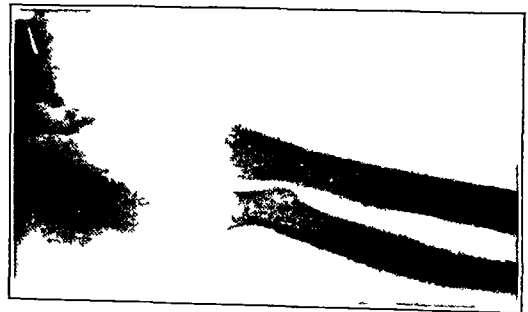
Fig 180 —Pte P   Flail elbow   loss of humeral condyles and olecranon

All the three following cases had a loss of at least 2 in of the humerus   in one the lower end, in the second 1 in above the elbow, and in the third at the middle of the shaft   In each case the limb was flail and quite useless before the operation   In each after operation, a mass of bone formed and filled the gap and though the union remained fibrous, being short it was stable, so that the strain was reduced to a minimum which much simplified the further plastic procedures that were undertaken   In the case of the flail elbow, after repair of the triceps tendon, the joint remained movable and useful for light work, which the man, being a clerk, preferred to an ankylosis   One of the humerus cases also regained control of the limb even while the union was fibrous

Unfortunately, the skiagrams of the conditions before operation got broken at an early stage

Fig 181 —Same case as Fig 180 after first operation (chip from ulna sown in —II)

FLAIL ELBOW TREATED BY CHIPS OF BONE FROM ULNA

Case 14 —Pte B   (Figs 180, 181)
April, 1918   Wounded, comminuted fracture of lower end of humerus, treated by immediate resection of the condyles of the humerus   resulting in a flail elbow   July   Scar tissue excised   bones forced together and sutured by periosteum   Elbow kept in successive windowed plasters till Dec   Jan , 1919   Ends of bone sawn off, divided up into small chips, and planted round   Kept in plaster till June   Much lateral mobility remains   Sept   Triceps tendon reconstituted by turning up a flap from ulna periosteum   Jan , 1920   Bones refreshed, humerus placed in front of ulna and fixed by a nail through the skin   May   Lateral mobility cured , can lift a chair and put hand to mouth

UNUNITED HUMERUS TREATED BY CHIPS OF BONE FROM ILIAC CREST
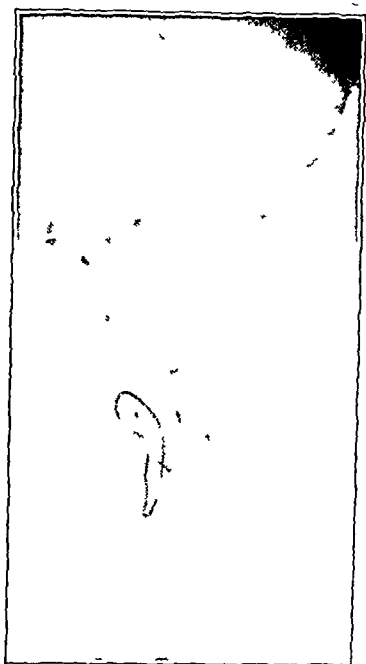
FIG 182 —Capt L　After first opera
tion (wired)
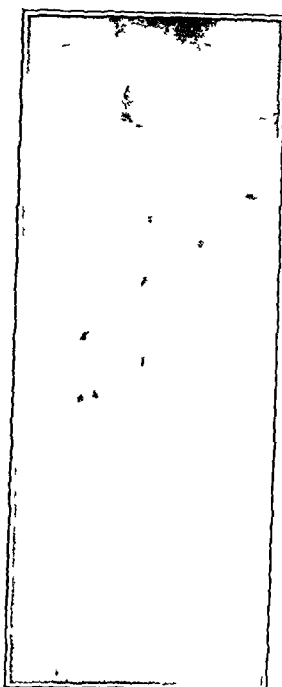
FIG 183 —Same case as Fig 182,
after second operation (chips from
iliac crest sown in gap)
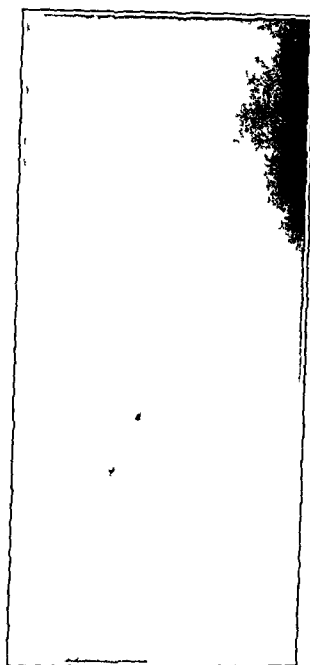
FIG 184 —Same case as Fig 183
8 months later　Fibrous union but
limb stable (chips survive)
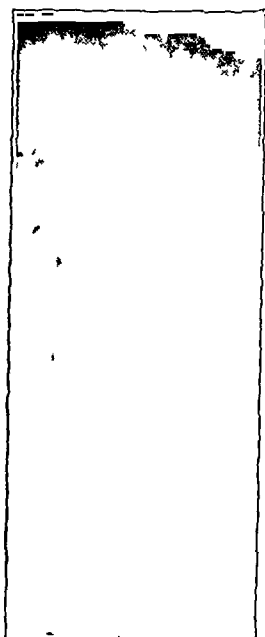
FIG 185 —Same case as Fig
183　Still fibrous union chip
survive 9 months after operation

Case 15 —Lieut A

April, 1918　Wounded　Fracture of humerus with musculo
spiral paralysis　Loss of 2½ in of humerus　*Aug*　Foreign body
removed and abscess drained　*Jan*, 1919　Ends of humerus re
reshed and wired, more debris being removed　*Sept*　Ends of
bone refreshed and the gap filled by chips from the iliac crest
June, 1920　Non union persists　Intramedullary graft from tibia
together with further chips from iliac crest　(Further progress
unknown)

Case 16 —Capt L　(Figs 182, 183, 184, 185)

Oct, 1917　Bomb wound 2 in blown away from left humerus
March, 1918　Bone ends refreshed　One separated fragment used
is an intramedullary graft　*Oct*　Non union　Bone ends freshened
and tied with kangaroo tendon　Plaster　*June*, 1919　Humerus
step cut and wired　*Oct*　Non union , wire removed , bones re
freshed and gap filled with chips from iliac crest　*June*, 1920　Still
some movement at fracture, but fair voluntary control of limb
Tendon transplantation for musculospiral paralysis

Method 3 —SLIDING　GRAFT

The sliding graft is one of the simplest, and in many
cases a most satisfactory one　Its advantages are that, coming
from the very bone to which it is to be applied, it corresponds
exactly in structure to the host, i e , in the proportion of
cancellous to ivory bone, etc , moreover, it is quickly applied
in its new bed, so that there is no fear of its suffering from
cooling or excessive handling

The disadvantages are that it is not nearly the calibre of the missing part which it has to replace, nor can it usually be taken large enough to withstand strain   For this reason it should not be relied upon alone where any but the shortest gap has to be bridged

The sliding graft is most effective in dealing with non-union of the tibia when the ends of the bone are almost in contact , if they are first freshened and placed in line, and then the Albee's saw is run continuously down from one fragment to the other, a graft will be cut from the longer fragment which fits exactly into a groove in the shorter one, the piece of bone removed from this latter being utilized to lie beside the other at the gap between the bone ends, so that the two together practically restore the original calibre of the bone
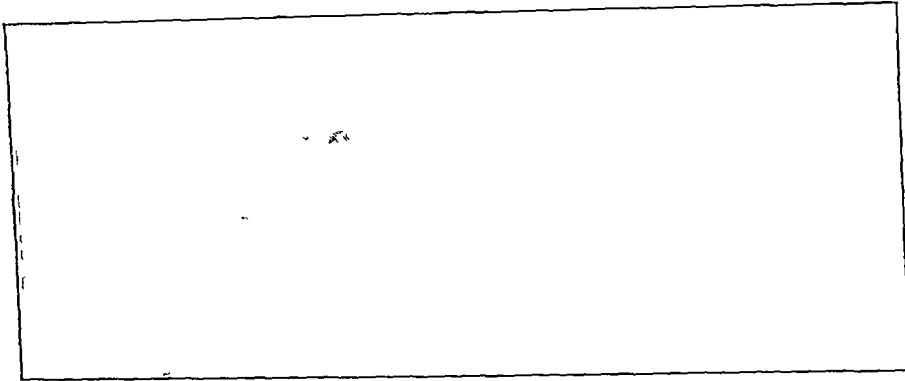
FIG 186 —Dvr H   Ununited ulna after first operation (trimming ends)
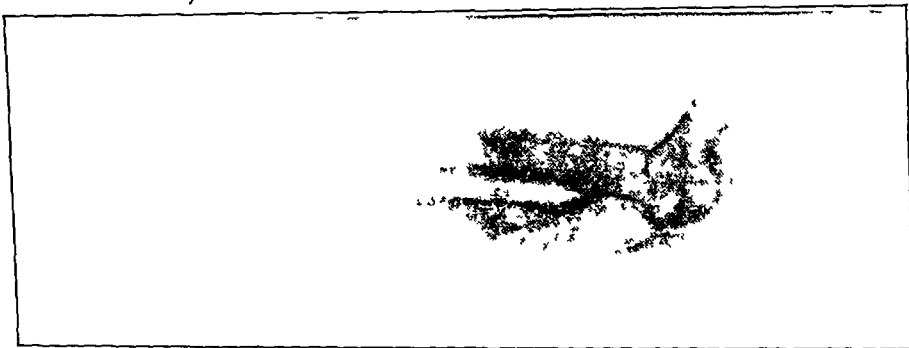
FIG 187 —Same case as Fig 186, after second operation (intramedullary graft from tibia)

The radius is another bone which adapts itself to sliding grafts, especially when the gap has been obliterated by shortening the ulna   The graft is best sliced up with a very wide gouge, which peels it up like a wood-shaving, the curve of the gouge just preventing splintering   A corresponding area on the shorter fragment is rawed by the gouge, and then the graft tied to both fragments by iodine tannic catgut ligatures (Nos 2 or 3)

The ulna being a less vascular bone than the radius, with usually a considerable thickness of sclerosed bone at the common site of non-union in the upper third, it is less often suited to the sliding graft   Two of the following cases, however, show that it can be useful   The case quoted above (Sgt C , Case 3) shows the excellent result which can be obtained on the radius

Successful cases of sliding graft of the tibia are common in every orthopædic hospital, and illustrate no special point to make them worth recording

Case 17 —Dvr H   (Figs 186 187)
Sept 1917   Wounded   Jeb 1918   Ununited fracture of ulna   Operation for cleaning ends of bone   May   Graft from tibia driven into lower fragment, and wedged against side of upper

fragment   *Aug*   Non union between upper end of graft and upper fragment   *Dec*   Sliding graft from lower fragment and first graft, over the gap—united by catgut   *April*, 1919   Good union, good function

This case shows that even a large intramedullary graft does not necessarily give mechanical stability, while union was ultimately obtained by a small sliding graft, which appeared to fulfil better the essential condition of wide exposure of raw bony surfaces

The next case is similar, except that the first sliding graft failed to give union, probably because too small a fragment was used, whereas, when the operation was repeated and a large slice used, good union resulted

Case 18 —Pte C   *(Figs* 188, 189)
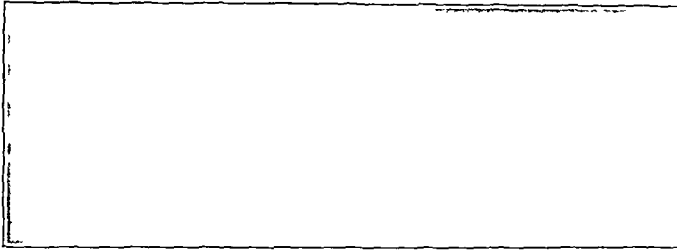
FIG 188 —Pte C   Ulna after intramedullary graft from tibia (false joint)
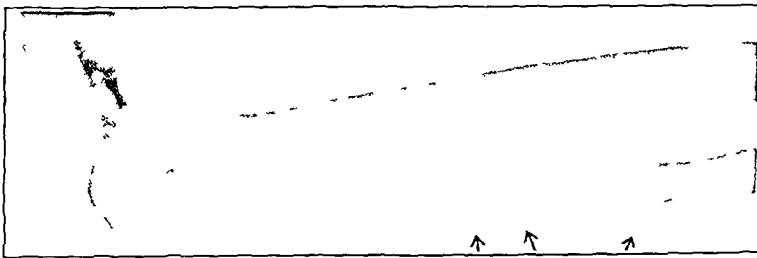
FIG 189 —Same case as *Fig* 188 after sliding graft taken partly from surface of previous graft   Good union

July, 1916   Wounded   *Feb* 1917   Healed   *May*   Admitted, ununited fracture of ulna   *Sept* 17   Sequestra removed and scar excised   *Nov*   Intramedullary graft from tibia to ulna   *June,* 1918   Non union between upper fragment and graft ,   small sliding graft *from upper* fragment placed across gap   *Feb ,* 1919   Union still weak   Long sliding graft from the upper fragment placed on deep surface of gap   *May*   Good union

The following case, where the precaution of first excising the scar was omitted, had severe recurrences of sepsis, yet united by means of a sliding graft , probably a large tibial graft in such a case would have acted as a foreign body, and come away without giving union

Case 19 —Pte M
Oct , 1918   Wounded   *Nov*   Admitted   Ununited fracture of ulna   *Nov*   Sequestra removed and bones refreshed and tied together with catgut   *Sept ,* 1919   Sliding graft   No preliminary excision of scar   Slight suppuration   *Jan ,* 1920   Small sequestrum removed   *Sept*   Firm union

The following case is another in which the sepsis was very persistent, the precaution of excision of the scar having also been omitted   intramedullary grafting and wiring both failed, while a sliding graft ultimately succeeded although the sepsis was not yet quiescent

Case 20 —Pte H , age 24   Admitted, ununited fracture of radius,
Aug , 1917   Wounded   Aug , 1918   Healed   May   Jan , 1919   Ulna shortened by 1½ in
mal union of ulna   June   Sequestra removed from radius   Oct   Sliding graft of radius   Suppura-
ends tied with wire   June   Wire removed, non-union   tion   March, 1920   Good union

The following case exhibited an interesting mal-union of the forearm bones, which
was successfully dealt with by excision of the head of radius, to allow rotation, and sliding
graft of ulna after correction of the deformity   It appeared from the history   that
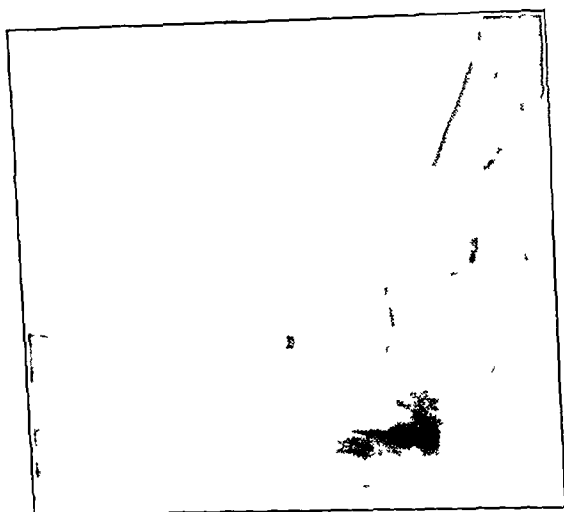
FIG 190 —Pte McK   Ankylosed elbow   mal union of radius and
ulna after manipulation

FIG 191 —Same case as
Fig 190 after first opera
tion   Excision of head of
radius and stepping ulna

ankylosis of the elbow had occurred in the
extended position, and that a surgeon had
attempted manipulation under anesthesia,
which had resulted in flexion at the frac-
ture of radius and ulna in upper third of
the forearm, which also remained fixed in
supination   This deformity interfered with
the pull of all the forearm muscles, which
rapidly improved after it had been cor-
rected   so that it would not have been wise
merely to correct the supination, as some
surgeons who saw the case advised   This
case also illustrates the danger of keeping
compound fractures of the forearm long in
the straight position   The Thomas splint
is excellent for immediate application, to
allow drainage   but as soon as the sepsis
is subsiding the elbow should be flexed, if
necessary under anesthesia, and usually

FIG 192 —Same case as Fig 190, after second
operation   Sliding graft of ulna   union elbow in
good functional position, good rotation of forearm

the limb can be satisfactorily fixed in plaster, with windows for the wounds   If the
manipulation is done at an early date and the precaution taken of splinting the fracture
with gutter splints before it is begun, the joint will yield rather than the fracture , if it
does not it is best left for open operation after the fracture has united

Case 21 —Pte McK   age 29   (Figs 190, 191, 192)
April, 1918   Wounded   Feb , 1919   Healed   March   Admitted   Fracture of radius and
ulna in upper third of forearm united at right angles   July   Removal of head of radius, wedge

removed from site of ulna fracture, ends of bone stepped and tied with kangaroo tendon , muscle placed between the radius and other bones   Oct   Weak union of ulna with ankylosis of elbow   Sliding graft of ulna   Humerus and ulna separated through open incision   Good union of ulna followed, but the upper part of graft was extruded   Elbow movements remained limited, but rotation of forearm was good

The following case represents the course and treatment of an uncomplicated sliding graft of the tibia   These cases are among the simplest and most satisfactory with which we have to deal, and it is unnecessary to record more than one in detail   The difficulties which may be encountered are   firstly, backward bowing, which is most safely corrected by a preliminary operation, with excision of scar tissue and the application of plaster in the corrected position , secondly, lack of active bone when the upper fragment consists of the head of the tibia only, so that the upper end of the graft is apt to lie loose in a cavity and become surrounded by clot which, when it organizes, will produce a fibrous union, in such a case it is best to supplement the sliding graft by one from the other tibia, so that the cavity is obliterated by pieces of bone , thirdly, if the patient walks too early without support, he is apt to break the graft, and spontaneous union is rare after such an accident

Case 22 —Pte T   (Fig 193)
July, 1918   Wounded   Oct   Healed   May, 1919
Admitted, with gap fracture of tibia   Aug   Sliding bone graft of tibia   Plaster   Walked with plaster on until Oct   Nov   Outside leg iron fitted   Good result

Fig 193 —Pte T   After operation Sliding graft of tibia   small fragment al o placed in gap   good union of both

Method 4 —INTRAMEDULLARY GRAFTS

The idea of the intramedullary graft is to fix the two fragments of bone in contact and in perfect aline ment by means of a bone peg driven into each medullary cavity

Ideal as this seems in theory, its practical application is by no means so simple   Firstly, it is often impossible to get the ends of the bone far enough apart to allow of the introduction of the peg into both fragments , this difficulty has been circumvented by some surgeons by putting the peg into the side of one fragment, which, however, is not certain to give the stability which is theoretically obtainable in the other way   The method of driving the graft in from one end of the bone, through the skin, while overcoming this drawback, has considerable technical difficulties

Secondly, the medulla of the forearm bones has so small a bore that the part of the graft which enters it has not much strength and is apt to break, even if the part between the bone ends is left thicker, like a cricket-ball

Thirdly, the area of raw bone from which osteogenesis is to spread is less in this method than in those where a large area on the side of the bone is freshened , indeed, is shown by repeated x-ray examination, the very place whence the maximum of early callus is formed, the medulla, is corked up by this method

The graft also plugs the most vascular part of the bone, from which new vessels should develop to nourish the graft, the clot from the open medulla being probably the source of these   Many x rays of intramedullary grafts show a zone of rarefaction around the implanted end of the graft, similar to that which is apt to develop round a wire or plate suggesting that it interferes with the nutrition of the neighbouring bone and acts almost like a foreign body

The intramedullary graft is useful in maintaining apposition of the ends of the humerus or femur, but it is safest to supplement it by a lateral graft

The advocates of the intramedullary method have numerous excellent results to show in its support, nevertheless they have always a certain number also where a false joint has formed at one end, and these appear to be in the very cases where there is special strain on the graft, which is the complication that the intramedullary graft was designed to overcome   The upper third of the ulna, where the upper fragment tends to be deflected outwards and backwards, is a notable instance of this   The following cases illustrate the point   In the writer's experience there is less tendency to false-joint formation with the lateral grafts

A considerable number of cases have been recorded above where intramedullary grafts failed to give union, and some other method had to be resorted to later   These have given the writer an unfavourable impression of the intramedullary method, especially as the operations were nearly all carried out by, or under the immediate supervision of, surgeons who had considerable experience of the method in civilian surgery before the war

The cases already referred to are   Pte McG , *Case 6* , Pte C , *Case 18*   Dvr II , *Case 17*

One case already described gave an excellent result, but in it the grafted bone was healthy, i e , the ulna, when the forearm was being shortened   Pte N , *Case 5*

Method 5 —INLAY GRAFTS

Inlay bone-grafts form, in the writer's experience, the most satisfactory method of dealing with an ununited fracture, where any considerable deficiency of bone exists

In its original form, as described by Albee, the inlay graft was fitted with the accuracy of a cabinet maker into its bed, which, though a simple process in theory, is by no means so when applied to actual bones with their natural irregularity, besides that acquired through the trauma   However, as we are not dealing with inert wood, where mechanical stability is of primary importance, but with living bone, which can and will modify its structure in accordance with outside conditions, other considerations are of more importance   Thus, the most accurate carpentry will not provide a union strong enough for satisfactory function if the blood-supply is deficient or the osteoblasts are so inactive that they do not weld the graft and host into one living whole , indeed, many grafts which give excellent x ray appearances immediately after operation are found to absorb or break in course of time   On the other hand, a graft which only fits roughly into its bed, but is thick enough to stand the initial strain and consists of vascular active bone in a similar bed, will unite rapidly and firmly, while ultimately the lines of stress will modify the form of the new bone, so that an approximation to the normal type is attained   In other words, the essentials are   (1) That the graft be thick and vascular , (2) That it be applied to as large a raw area of the host as possible , (3) That the maximum area of cancellous bone be exposed, consistent with stability , (4) That the junctions of the graft with host be protected from ill strain until callus unites them (usually four to six weeks), and then be subjected to small degrees of strain, such as muscular contractions against resistance (i e without movement), whereby the new bone is stimulated to grow and to harden

These conditions can usually be attained by the use of grafts cut from the subcutaneous surface of the tibia, with its periosteum, which ensures the retention of the surface osteoblasts   the graft is applied to slots which have been cut on corresponding surfaces of the two fractured ends   the graft is held by ligatures of iodine-tannic catgut, which prevent displacement while a plaster cast is being applied   The plaster is worn for about four weeks, being merely split on one aspect if the limb should swell unduly , then it is valved for removal of the stitches and massage, and is retained for about another four weeks, or to whatever period is required for firm union   Periodic x-ray examination of cases with non-union suggests that early and excessive strain on the graft is next to sepsis, the commonest cause of failure

The following case records, with their skiagrams, show what satisfactory results can be obtained by a technique which is absolutely simple   The only special experience which it requires is in the use of the electric saw and in the application of plaster   A cast applied at the operation must be applied very evenly and over a thick layer of wool which must also be evenly distributed , this precaution usually compensates for any swelling that may occur , in certain cases there may still be excessive swelling, but if the cast is split down the whole length (not merely a portion) of one aspect, i e , the one where strain is least, then the œdema will rapidly subside and there will be no tendency to deformity   In the upper limb, if the digits are carefully left free so that the act of closing the fist can be carried out, this will provide a degree of function which stimu lates bone-growth without straining the graft   In the lower limb, a cast which fits well enough to allow walking attains the same end   The writer has found the appli cation of a plaster metatarsal bar very effective in preventing weakening of the footpiece of the cast with the consequent tendency to equinus   Even if the patient is foolish enough to walk out in the damp with the cast, a thick metatarsal bar will usually hold the foot firm

The fact that the graft can act as a source of new bone seems proved beyond possi bility of error by the following case, in which a wide gap in the ulna had been bridged by a piece of tibia, and good union had occurred at the ends of the graft , then the patient snapped the graft in its centre, far from the original ends of the ulna, yet union occurred within i few weeks by ensheathing and central callus   It does not appear from the x rays that the fresh callus could have had any other source than the graft, as the latter had not been in place long enough to have been reconstructed *in situ*, as most grafts seem to be ultimately

Case 23 —Pnsr R   (*Fig* 194)
Dec , 1918   Kicked by horse   *May*, 1919   Ulna plated   *Feb* , 1920   Admitted   Ununited fracture of ulna, screws having become loose   Man could not lift i weight   *Feb*   Sliding graft of ulna, after removal of plate   *June*   Non union   Tibial inlay graft   Bone ends trimmed until

IK 194 —Pnsr R   Graft uniting spontaneously by lateral and central callus

i 2 in gap was left, deep aspect of each fragment rawed for 1½ in   Five inch tibial graft tied in place with catgut   *Jan* , 1921   Returned with fracture of graft in its centre, the result of heavy work   Ends well united   Plaster applied for three weeks, after which callus union occurred on the deep surface of the graft, away from the ulna   Firm union after nine weeks

The [following case illustrates the value of a strong tibial graft as a source of bone in one of the] most disabling injuries with which the orthopædic surgeon has to deal, i e   a flail shoulder in which about the upper half of the humerus has disappeared   In the case quoted, if an attempt had been made to fix the upper end of the shaft in the remains of the glenoid, the limb would have been shortened beyond use , more over it is unlikely that any form of ankylosis could have been attained, with so much strain on the union   Here a tibial graft resulted in a fibrous ankylosis without exces sive shortening, and such as restored useful function to the limb, even though far short of the normal

Case 24—Sgt McC , age 22   (*Figs* 195, 196, 197)

Nov, 1916   Wounded left shoulder   bone freely removed   *May*, 1917   Healed   *July* Admitted   Flail shoulder, with about 4 in missing from upper end of humerus   *July*   Graft from tibia 3½ in long, driven into humerus   Arm in abduction splint   *Aug*   Upper end of graft had slipped out of glenoid , replaced, arm and chest put up in plaster   *May*, 1918   Good function , can lift arm to occiput and carry moderate weights

FIG 195—Sgt McC   Flail shoulder   loss of 4 inches from upper end of humerus

FIG 196—Same case as *Fig* 195, after operation   Bone graft from tibia (slipped out of glenoid)

FIG 197—Same case as *Fig* 195, one year after operation   shoulder stable   graft much thicker   much new bone formed

The following two cases illustrate the course of uncomplicated forearm fractures treated by inlay grafts from the tibia

Case 25 —Pnsr M , age 22   (*Fig* 198)

Oct , 1918   Wounded   *Feb* , 1919   Healed   *May*, 1920   Admitted   Non union of ulna just above the middle , ulnar deviation of hand and inability to lift   *Sept*   Inlay tibial graft, 5 in long, applied to the deep surface of ulnar fragments   Four months later union firm and function good
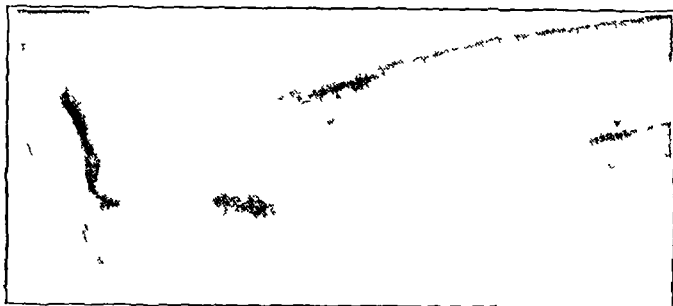
FIG 198 —Pnsr M   Lateral graft from tibia to ulna , firm union

Case 26 —Pte S , age 22

July, 1916   Wounded   *Feb* , 1917   Healed   *Jan* , 1917   Admitted with gap in middle of radius   *March*   Bone graft from tibia to radius 4 in long, tied to deep surface of radius by fine wire   Wound broke down several times   *Dec* , 1918   Wound healed finally   *March*, 1918 Firm union, good function

In this latter case, it is likely that the wire helped to keep alive the sepsis and induced the bone necrosis noted above   It is astonishing that the flares were so mild, considering the short period for which wounds had been healed before the operation   This was one of the earliest cases done at Bangour, before the prophylactic and diagnostic value of heavy massage had been realized and become a routine

In the space at our disposal it is impossible to give in detail all the cases which are instructive, but it is hoped that the study of those recorded above may impress on the reader the common difficulties and sources of error   They have been chosen among the ones which presented difficult problems, or in which some procedure, commonly recommended, had failed, either from its being unsuitable to the type of case, or from errors in the execution   While some of them are depressing reading, as records of repeated failure, yet they show that in almost all cases success can ultimately be attained, if the patient and surgeon both possess patience and determination

Method 6 —PLATING

Of the use of plates the writer cannot speak from personal experience   A certain number of failures after this method have come for further treatment, and union has been attained by the methods described above   Although all methods result in some failures, the following considerations appear to the writer to weigh seriously against the use of metal plates —

1   After gunshot injuries there is the ever-present fear of a recrudescence of sepsis and this risk is increased by the presence in the tissues of a foreign material, such as a plate , if a flare-up should occur, it will not subside till the metal is removed, which probably entails a second operation , whereas a certain number of bone-grafts unite even in the presence of sepsis , and if they do not, the dead bone tends to break up and come away spontaneously without much delay

2   Metal tends to cause an area of rarefaction in the bone immediately surrounding it, which is well shown by x rays   so that screws are apt to become loose, and the very mechanical stability, which was the chief recommendation of the metal, is annihilated

This effect is most marked in the presence of strain, i e , in the very cases where other methods are difficult

3 Non-union is usually associated with sclerosis of the bone at the site of fracture, and mere fixation of such avascular ends is usually insufficient to induce the formation of sufficient callus When a vascular graft is applied and the atrophic bone trimmed away, then absolute fixation is found to be unnecessary , indeed, a wire or plate is apt to interfere with the vitality of the graft

4 Even when plates are used it is usually necessary to supply some outside support also , whereas, when plaster is applied, the temporary fixation of catgut is enough to prevent slipping while the cast is being put on, so that the strength of the metal is no advantage, while, as noted above it does not always retain a good hold after the month at the end of which the plaster is removed

Method 7 —GRAFTS OF IVORY OR BOILED BONE

Of heterogenous grafts and those of ivory or dead bone the writer has no personal experience Many of the arguments used against metal apply to them, and as there is always in the patient's tibia and iliac crests a supply of living bone of various types, it is difficult to see the indication for these extraneous materials

One final point is worthy of careful attention, i e , that in cases of non-union after gunshot injuries the condition of the bone is only one factor in the patients' disability, not always the most important one Usually several muscles have been shot away with the bone which leaves the gap , often a nerve is cut or compressed , more often still the severe sepsis which may have helped to prevent bony union has left tough adhesions in or around the joints If these conditions are not treated adequately, the most perfect bone operation will merely have put the patient to much inconvenience and some suffering without improving the function of the limb For instance, non-union of the radius in the lower third is nearly always accompanied by loss of the extensors of the thumb, and without them the thumb is almost useless, and accordingly the whole limb almost functionless , in the upper-third fractures it is the posterior interosseous nerve which has suffered, and unless its muscles are restored by some form of tendon-transplant, the hand is valueless Similarly, severe fractures of the tibia are apt to interfere with the tibialis anticus, one of the most important muscles of the lower limb These remarks may seem unnecessary, as the logic of the matter is obvious on paper , but it is extraordinary how often this aspect of a case is overlooked in practice, unless a routine of examination for the joints, muscles, nerves, and blood-vessels is carried out in every case of injury to a limb

EPONYMS

II —'BAKER'S CYSTS', AND BAKER'S TRACHEOTOMY TUBES

Mr Morrant Baker s paper "On the Formation of Synovial Cysts in the Leg in Connection with Disease of the Knee joint " lies buried in the thirteenth volume of the *St Bartholomew's Hospital Reports*, 1877, pp 245–261 "the family mausoleum   as the Reports were once wittily called by Sir Thomas Smith, the editor, looking to the close body from which they emanated and the very limited circulation they attained

Mr Baker states that his "attention was first drawn to the diseased condition which forms the subject of the present paper by the following case which was under the care at different times of my colleagues, Mr Callender and Mr Marsh, and of myself

" For the notes of the case I am indebted to the Records of the Surgical Registrar, Mr Butlin

"LARGE CYST IN THE CALF OF THE LEG—OSTEO ARTHRITIS OF KNEE-JOINT—AMPUTATION

" A woman (M S), 38 years old, was admitted into St Bartholomew s Hospital, under the care of Mr Howard Marsh, July 22, 1873, with a large swelling in the calf of the right leg   The right leg was about twice as large as the left, from just above the knee to the ankle   There was slight œdema, and the superficial veins looked tortuous and dilated There was no great pain or tenderness, and no hardness or swelling could be felt in the track of the popliteal vein   The swelling was generally uniform, but especially marked in the calf, where deep seated fluctuation could be felt   A slight pulsation was also perceptible, but was apparently only transmitted   There was also some effusion in the knee-joint   The patient was thin, but otherwise in fair health, and complained only of numbness and very slight pain in the leg

" The history given by the patient was that five months ago the right leg began to swell, and had continued since slowly increasing   She thinks that, as she stooped one day, something cracked in the knee, and from that time it began to swell   She has had swelling of the leg after each confinement

" At a consultation which was held on the case, it was generally agreed that there was a quantity of fluid, perhaps pus, beneath the superficial calf-muscles, with probably thrombosis of the deep veins

" A day or two after the patient s admission to the Hospital, the swelling in the calf was punctured by Mr Marsh with a very fine trocar, and several ounces of fluid were drawn off, leaving behind a considerable amount of thickening   Much to the surprise of those present, the fluid was not purulent, but apparently cystic   It was translucent, pale red, viscid, slightly turbid, and alkaline   It contained a large amount of chlorides, and was almost solidified by heat and nitric acid   Microscopic examination failed to detect more than the presence of blood-corpuscles , there were no pus cells

" *July 28* —The fluid has apparently collected again   The measurement of the right calf is 13_8 in , that of the left, 9_8^5 in   There is no enlargement of the femoral or inguinal glands   The swelling and thickening of the leg seems to be chiefly in the upper part of

the gastrocnemius, especially in front of the muscle, and in its external head, and between the two heads as well as some three or four inches lower   The swelling below the calf is probably only œdema, on account of the pressure above

" *July* 31 —The swelling in the lower part of the leg is much diminished

" Since her admission the patient has been unable to retain either urine or fæces, which all pass involuntarily   This has been so, it is said, for some time past   An examination of the vagina and rectum, however, has discovered no abnormal condition, and throws no light on the condition of the leg

" *Aug* 4 —The leg is generally much smaller and less painful   Measurement of the calf is 12 in   The condition of the knee is not changed

' *Aug* 16 —The thickening in the upper part of the calf is much less   The knee is bandaged

" *Sept* 5 —There is still some thickening in the upper part of the calf   The knee, in spite of careful and constant bandaging, is gradually increasing, apparently on account of the fluid in the joint   The leg is now abducted and slightly everted

" *Sept* 17 —The thickening in the upper part of the calf is apparently permanent, but not manifestly increasing   The knee is still enlarging   The patella is now much displaced outwards, the leg is still more abducted, and the foot everted   It seems as if there were some enlargement of the upper end of the tibia or the lower end of the femur   Measurement around the knee is 15½ in , and around the lower end of the femur 16 in

' Soon after the last note the patient left the Hospital, but was re-admitted in August, 1874, under the care of Mr Callender, on account of the condition of her knee-joint   In his absence she was for a time under my care, and I had many opportunities of observing the state of her limb

' Since she had left the Hospital, the swelling of the knee had to a great extent subsided   About two months, however, before her re admission she fell down, and from that time the leg has been 'out of place', and dangling loose and useless   There has not been very much pain   At the time of her re admission the right tibia was found dislocated outwards and backwards, and the leg hung loose and flail-like   It could be twisted easily in all directions, and even replaced in fair position, from which, however, it at once reverted to its mal position when restraint was discontinued   The bones grated at the knee-joint, as if they had lost their cartilage   The synovial membrane was not now very much thickened, and there was no pain or tenderness, even on free movement

' The whole of the extremity was atrophied   No trace of the cystic disease of the calf, or even of thickening in this part, could be detected

' Attempts were made to improve the position of the dislocated bones, and to give such mechanical support as would enable the limb to be used, but without success, and imputation of the thigh was performed by Mr Callender in January, 1875

" EXAMINATION OF THE LIMB AFTER REMOVAL —The joint-surfaces were found in great part denuded of cartilage, smooth and eburnated, having nodules of bone growing out from their edges   Portions of the cartilage remaining were soft, vascular, and pulpy   The ligaments had been almost wholly destroyed   The synovial membrane was thickened, many of its processes standing out on its interior like small firm fibrinous nodules   A considerable quantity of viscid fluid was in the joint

" No trace of the cyst in the calf could be discovered

" On thinking over this case, it seemed to me more than probable that the supposed cyst in the calf of the leg was formed really by a collection of fluid which had escaped from the interior of the knee-joint   The character of the fluid, the progress of the case as it developed, and the total disappearance of the cyst—so that even on examination of the limb after removal no trace of it could be discovered—all seemed to favour this view of its nature "

Details of seven other cases are given, and Mr Baker then proceeds to discuss the route which is taken by the fluid when making its way out of the knee-joint to form an artificial synovial cyst in the neighbouring tissues

The paper ends with "The following are the conclusions deducible from the foregoing cases —

" 1 That in cases of effusion into the knee-joint, and especially in those in which the primary disease is osteo-arthritis, the fluid secreted may make its way out of the joint, and form by distention of neighbouring parts a synovial cyst of large or small size

" 2 That the synovial cyst so produced may occupy (a) the popliteal space and upper part of the calf of the leg, or may (b) be evident in the calf of the leg only, projecting most, as a rule, on the inner aspect of the leg, or (c) may be perceptible only at the upper and inner part of the leg as a small defined swelling, not approaching within three or four inches of any part of the knee-joint

" 3 That, however large the synovial cyst may be, fluctuation may not be communicable from it to the interior of the knee-joint , but the absence of such fluctuation must not be taken to contra-indicate the existence of a connection between the joint and the cyst

" 4 That the synovial cyst may be expected to disappear after a longer or shorter period, without leaving traces of its existence, even on dissection of the limb

" 5 That the cyst should not be punctured or otherwise subjected to operation, unless there appear strong reasons for so doing , inasmuch as interference may lead to acute inflammation and suppuration of the knee-joint

" 6 That most often the disease in the knee-joint will be found to have begun some time before the appearance of the secondary synovial cyst , but sometimes the patient's attention may be first drawn to the latter, or the cyst may seem for a long period the more important part of the disease "

It is interesting to note how this opinion is borne out The case on which these observations is founded presents all the characters of a tabetic arthropathy, a condition but little known to surgeons in 1877, though it had been described by Charcot, Clifford Allbutt, and other physicians

The series of synovial cysts in connection with joints was enlarged, and the pathology was placed upon a more sound footing, by contributions to the Pathological Society of London in 1885 and 1887

BAKER S RUBBER TRACHEOTOMY TUBES

Mr Morrant Baker read a paper before the Royal Medical and Chirurgical Society on November 28, 1876, entitled " On the Use of Flexible Tracheotomy Tubes " The paper is published in *The Medico Chirurgical Transactions*, 1877, lx, 71–84 He says —

" It had long occurred to me that an elastic tracheotomy tube might be constructed which would answer all the purposes of the rigid cannula, and at the same time be free from its disadvantages , but it was only last year that my idea was brought into working shape by my friend Mr Paley, House Surgeon to the Evelina Hospital, to whom I am indebted for taking much trouble in superintending the construction of an indiarubber tube, made by Mr Milliken, of St Thomas's Street The tube was made of ordinary indiarubber, and answered the purpose for which it was intended very fairly , but it was evident that a better material would be preferable, and the cannulæ have been since constructed of vulcanized red rubber, a material which is in a high degree elastic, tough, and durable, and remains almost unaltered after long soaking in pus or other like fluids

' The shape of the cannula is that of the ordinary silver tracheotomy tube There is no laryngeal opening, but this can be made at any moment, with a sharp knife or scissors, at the part of the tube which seems best for the case in which it is being used The tube is single, and it has been found hitherto so easy of introduction and withdrawal, or in other words, one tube can be so easily replaced by another, that I have not thought it necessary to devise a combination of inner and outer tubes, as in the case of the silver cannulæ commonly in use "

Mr Baker then proceeds to point out the advantages and disadvantages attending the use of such a tube, and gives notes of cases in which it had been employed, including one from Mr H H Clutton, who was then acting as resident assistant surgeon at St Thomas's Hospital

William Morrant Baker, the son of a solicitor, was born at Andover in 1839, and was assistant surgeon and surgeon to St Bartholomew's Hospital from 1871 to 1892 He lectured on physiology in the medical school, and edited the 6th to the 13th editions of Kirke's *Physiology*, a popular text-book on physiology which was subsequently issued under the supervision of Professor Halliburton Baker introduced the practice of removing the tongue in two halves, an operation which he usually performed by splitting the organ longitudinally and then removing each half with an *ecraseur* His ingenuity is shown by the fact that as early as 1860 he had invented a reading lamp with a metal bar of about a quarter of an inch in width in the long axis of the flame immediately above the burner The flame being thus divided, there was a more perfect combustion of oil, with a considerable increase in its illuminating power The principle afterwards became universally recognized as the 'duplex burner' He died after a long illness on Oct 3, 1896

CHRONIC DUODENAL ILEUS

By D. P. D. WILKIE, Edinburgh

THE condition known as acute gastromesenteric ileus or acute arteriomesenteric ileus is now a well-recognized entity   Whilst all cases of acute post-operative dilatation of the stomach may not be dependent on pressure on the third part of the duodenum by the superior mesenteric vessels, it is clearly established from a large number of operative and post-mortem observations that compression of this part of the duodenum is the common cause of the acute duodenal and gastric dilatation   It is also proved that treatment based on this view of the pathology of the condition is almost uniformly successful if resorted to promptly and thoroughly   The prone position with elevation of the pelvis, in conjunction with the use of the stomach tube, has rendered a formerly grave and usually fatal complication an eminently curable one

Whilst examining the duodenum in several hundred cases in the post-mortem room, I was struck by the presence in a certain relatively small proportion of them of what appeared to have been a chronic dilatation of the first three parts of the duodenum up to the mesenteric vessels   A study of the histories of these cases threw practically no light on the duodenal condition   Most of them had died from disease outside the alimentary system, and, except for a note of digestive disturbance, no record of any significant symptoms could be found

Experimental work on closed duodenal loops had shown me how toxic retained duodenal content may be and how critical a region of the digestive tract the duodenum unquestionably is   When, in addition, one considered how rapidly fatal an untreated acute gastromesenteric ileus is, the very natural and pertinent questions arose   (1) *Does a chronic obstruction of the duodenum from mesenteric compression never occur?* (2) *If it does occur, does it give rise to no recognizable clinical picture?* (3) *May it not be the precursor of the acute post-operative condition?*

All who have interested themselves in this subject are familiar with the records of cases of fatal acute dilatation of the stomach occurring independent of any operative procedure under general anæsthesia   cases, for example, arising after fractures requiring treatment in the recumbent posture, and cases where the condition apparently set in spontaneously without any operation or accident   The link in the chain of evidence which one desired, however, was the case where the full-blown acute and fatal condition followed on a previous chronic gastro-intestinal picture

Some two and a half years ago, an important link in the chain of evidence was furnished by the following case of a patient who came under my care in the Royal Infirmary, Edinburgh —

Case 1 —Female, age 63   admitted to hospital with the diagnosis of ' acute intestinal obstruction'   The patient was so ill that a detailed history could not be obtained, and as she lived by herself and had no intimate friends, the following facts were all that could be obtained   For years she had been troubled with her stomach and suffered from chronic constipation   For the past three weeks the trouble had been aggravated, and she had vomited daily and had kept no food down   For the past week, vomiting had been constant, day and night, and for four days there had been no action of the bowels or passage of flatus, in spite of enemata   The vomit had been for the most part green and bilious, latterly however, it had been darker in colour

On Examination —Patient looked very ill with sunken eyes, dry tongue, a subnormal temperature   and a small thready pulse, rate 140   She was emaciated   The abdomen was tumid and tense   on palpation, splashing was readily elicited in the umbilical and hypogastric regions   No tumour was palpable anywhere   Immediate operation was undertaken

Operation —The abdomen was opened in the mid line in the umbilical region   An enormously

distended stomach was found filling almost the whole abdomen   A stomach tube was passed and 8½ pints of dark bilious fluid were drawn off   As the stomach receded it was seen that the duodenum was greatly dilated in its first two parts, and, on lifting up the transverse colon, the third part of the duodenum was seen bulging forwards, greatly dilated, and distended up to the point at which it was crossed by the mesenteric vessels   Beyond this, the intestine was collapsed   On pulling up the loops of small intestine, which were all lying in the pelvis, they were seen to be empty, but congested, and to be studded with small ecchymoses   (The cause of the latter was found to be pressure on the superior mesenteric vein by the greatly dilated third part of the duodenum, which
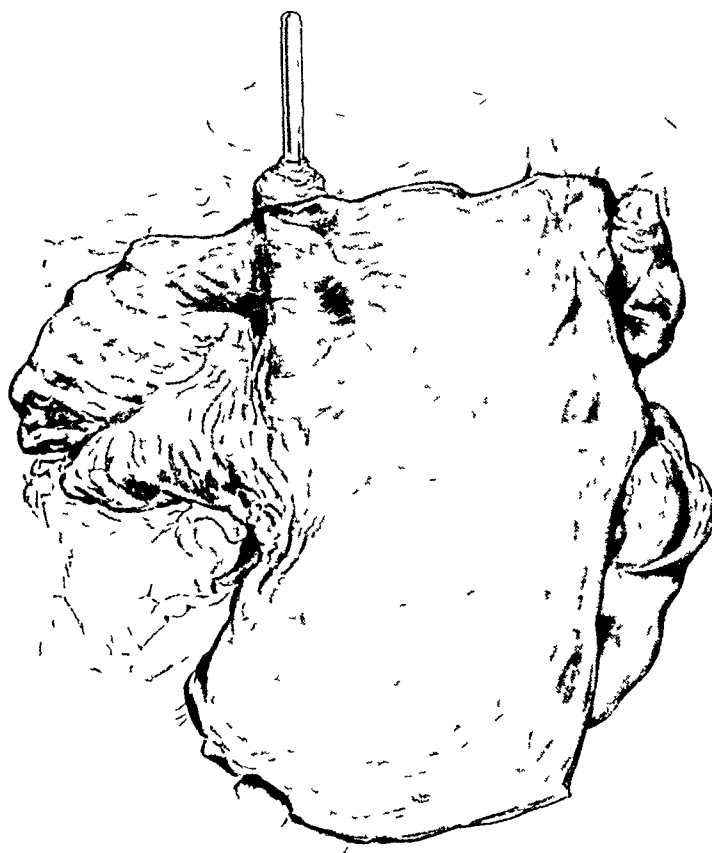
Fig 199—Third part of duodenum opened and viewed from behind   Stilette in superior mesenteric artery   Note great dilatation proximal to vessel   normal calibre beyond it

had bulged over the accompanying vessels and also almost certainly to pressure from the great weight of the dilated stomach)   A posterior gastro enterostomy was performed   In spite of the administration of large quantities of saline intraperitoneally and subcutaneously, the patient never rallied   and died twelve hours after the operation

Post mortem —The operative findings were confirmed   The great dilatation of the duodenum was found to end abruptly at the crossing of the superior mesenteric artery (Fig 199)   There was no evidence of any acute infective process anywhere which might have caused an acute toxic dilatation of the stomach

The foregoing case settled in my mind quite definitely the question as to whether the condition of chronic duodenal obstruction occurred and was of clinical importance The next bit of evidence was furnished by the case of a man who died with unusual rapidity after the perforation of a chronic duodenal ulcer   The following brief notes of his case are given —

Case 2 —Male, age 37   Had suffered for some nine months from indigestion   For three days before the onset of perforation he had been out of sorts and said to be suffering from gastric

Fig. 200 —Duodenal obstruction associated with perforated duodenal ulcer   Note dilated and congested duodenum up to level of root of mesentery

catarrh   At midnight on April 2, 1920, whilst in bed, he was suddenly *seized with very severe abdominal pain*   When seen by the doctor at 7 a m , he was found in a state of collapse and was sent to hospital   On admission at 11 a m , patient was in a state of intense shock and was obviously moribund   He could not stand a general anæsthetic, but under local anæsthesia, an attempt was

made to close the perforation   On opening the abdomen a very great quantity of bile stained exudate escaped   He died on the table, however, within twelve hours of the original perforation

The question arose as to why this well-developed man should have succumbed so quickly to a perforation of no great size, coming on as it did, whilst he was on low diet and under treatment for so called gastric catarrh

Post mortem.—The first, second, and third parts of the duodenum up to the root of the mesentery were very markedly dilated   the mucosa being intensely congested   in striking contrast to the pale mucosa beyond   No evidence of disease in other organs was found to account for the rapid collapse after the perforation

In this case, it would appear that the rapid collapse and death were due to the sudden escape into the peritoneal cavity of a large quantity of retained and toxic duodenal
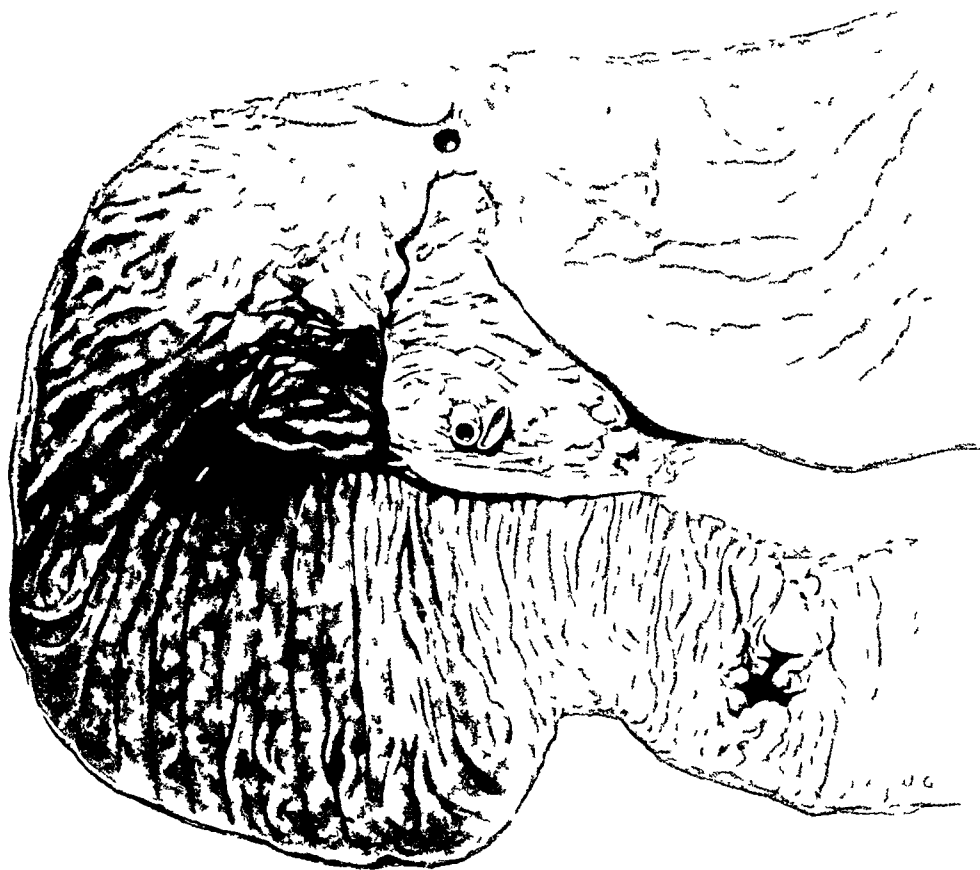
Fig. 201.—Duodenal obstruction causing vicious circle after gastro enterostomy for duodenal ulcer   The opening in the jejunum was the lateral anastomosis described in Case 3

contents from a dilated duodenum, the symptoms being almost anaphylactic in character and closely resembling those in animals with a closed duodenal loop

The next piece of evidence was from the following case of death from 'vicious circle' after gastro enterostomy.—

Case 3—Mrs. J. B.   age 44   Had complained of occasional stomach trouble since the age of 13   but had been in fair health until four months before operation   At this time she began to

suffer from severe pain in the epigastric region coming on usually about two hours after food, frequently accompanied by vomiting, which always relieved the pain She frequently suffered from great nausea, coming on at irregular times and followed by vomiting, which gave instant relief Rest in bed and milk diet relieved her symptoms but a return to more ordinary diet was followed by a recurrence of the pain, nausea, and flatulence After treatment for ten weeks in a medical ward, a surgeon was called in From the irregularity of the symptoms, and the fact that there was some tenderness in the right iliac and lumbar regions it was thought that the gastric symptoms might be reflex from the appendix or proximal colon

FIRST OPERATION Dec 17 1920 —Through a high gridiron incision, the appendix which showed little abnormal, was removed and a very mobile proximal colon was fixed after the method of Waugh

SECOND OPERATION, Jun 4, 1921 —Epigastric incision A dilated and hypertrophied stomach and a duodenal ulcer causing definite stenosis just beyond the pylorus were exposed A posterior gastro enterostomy with a short loop was performed The patient continued to vomit daily after the operation, for the most part bilious material

THIRD OPERATION, Jan 21 1921 —The abdomen was re opened in the epigastric region and an entero anastomosis between the two limbs of the loop was performed It was noted that the proximal loop was not distended, as had been expected would be the case After the third operation she continued to bring up mouthfuls of bilious fluid and gradually became more emaciated, refusing all food In spite of absorbing large quantities of saline and dextrose per rectum she gradually sank, and died five days later

POST MORTEM —A duodenal ulcer causing marked stenosis of the first part of the duodenum was found Beyond this, the duodenum was greatly dilated up to the crossing of the superior mesenteric artery The mucosa was engorged and congested Beyond the root of the mesentery the bowel was pale and empty, and the entero anastomosis was unavailing, as it was performed 2 in beyond the seat of obstruction (*Fig* 201)

✓   This case again brought home to me how important a factor duodenal obstruction may be in causing death from regurgitant vomiting, and also how it may be associated with the presence of a very definite organic lesion in the first part of the duodenum

The next case was the first in which I recognized the condition of chronic duodenal obstruction during life and treated it at operation The history of the case is significant, as I believe it represents what is the typical picture of chronic duodenal obstruction from compression by the mesenteric vessels

Case 4 —Female, age 38, married, six children Complained of pain in the epigastrium after food pain under the right breast, flatulence and vomiting

HISTORY —Ever since she was a young girl, patient has been bothered with flatulence after meals Six years ago she had an attack of severe indigestion accompanied by vomiting lasting for several weeks Two years ago she consulted her doctor for pains under the right breast, distention with wind after meals, and vomiting Her doctor treated her for a sluggish liver but without improvement During the last two years she has never been free from pain and flatulence after food, and has always had to loosen her clothes after eating During this time she has had several attacks consisting of, first, severe headache, blackness before the eves, then a feeling of nausea and epigastric discomfort, followed by bilious vomiting, which gave her relief She has lost 28 lb in weight during the past two years For many months her diet has consisted of milk, tea and biscuits If she took more solid food she had within an hour a sensation of distention sometimes almost amounting to bursting in the epigastrium, only relieved by vomiting After one of the attacks from which she suffered, her friends remarked that she was yellow and hollow eyed When she vomited she brought up large quantities of fluid, usually, though not always, yellowish green in colour During the last two attacks of pain and vomiting she has had definite shivering

ON EXAMINATION —The patient was thin and hollow eyed The abdomen was flat There was definite tenderness under the right costal margin, and the upper part of the right rectus muscle was rigid

✓PROVISIONAL DIAGNOSIS —' Gall stone in common duct '

OPERATION, Feb 11 1920 —On opening the abdomen through the right rectus the gall bladder was found to be normal in appearance and no gall stones were present , the common duct was slightly dilated but no stone could be felt The stomach was distended with gas, the pylorus was widely dilated, admitting three fingers, and the first part of the duodenum was enormously dilated, resembling a second stomach (*Fig* 202) The second half of the duodenum was likewise dilated On throwing up the transverse colon, the third part of the duodenum, greatly dilated bulged up into the wound The dilatation extended to where the superior mesenteric vessels crossed the duodenum , beyond this the duodenum was collapsed and empty (*Fig* 203) On passing a finger behind the mesenteric vessels, which were tightly stretched across the duodenum, and raising them gas immediately escaped onwards into the jejunum

The obvious treatment was to anastomose the dilated third part of the duodenum to the jejunum The peritoneum of the posterior abdominal wall over the duodenum was incised, the
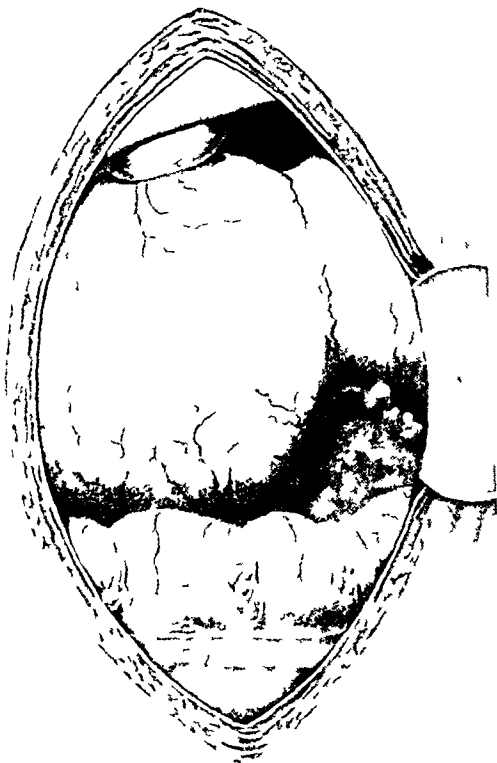
FIG 202.—Great dilatation of first part of duodenum and pylorus as seen at operation in *Case 1*
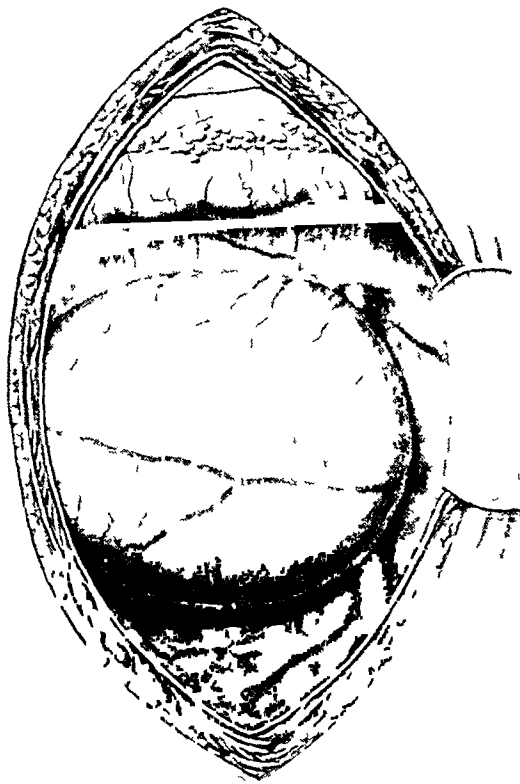
FIG 203.—Distended third part of duodenum in *Case 4* bulging into wound when transverse colon was thrown upwards
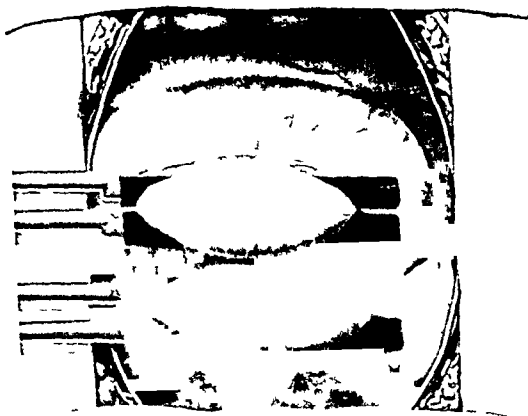
FIG 204 Clamp in position for duodenojejunostomy
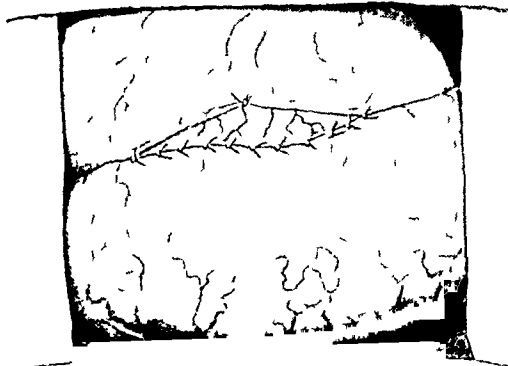
FIG 205.—Completion of duodenojejunostomy, peritoneum fixed to duodenum by one linen suture

third part mobilized, and an angled Brunner's clamp applied   The jejunum 7 in from the duodenojejunal juncture was likewise clamped, and a lateral anastomosis performed (*Fig* 204) Interrupted linen sutures were used for the outer layers, and continuous catgut for the inner layers When the anastomosis was completed, the parietal peritoneum was fixed to the duodenum by one linen suture (*Fig* 205)

The patient made an uninterrupted recovery, and within a week after the operation was taking articles of diet which she had not dared take for years previously   An *x* ray photograph taken three weeks after the operation, two hours after a bismuth meal, showed that the duodenojejunal anastomosis was functioning well

Ten weeks after the operation, the patient had gained 21 lb in weight, and was feeling and looking very well

This case was for me an epoch-making one, because of the clear cut history, the unmistakable operative findings, and the striking improvement following drainage of the dilated duodenum   It was also most instructive in this respect, that the dilatation with gas which was present at the time of operation, and which made the condition so evident, pointed the way in which less pronounced cases might be demonstrated at operation, namely, by the artificial distention of the stomach with gas after the abdomen has been opened   Subsequently I have found this practice of passing a stomach tube and distending the stomach during the operation an invaluable aid in distinguishing the presence of duodenal obstruction

I have given the cases in some detail, because they represent the successive steps which led to the final recognition of what I take to be a definite pathological and clinical entity   Since then I have encountered and treated seven similar cases, and have found in a study of the literature that others have described and treated cases which appear to be identical

Etiology —The third part of the duodenum in the normal subject is slightly compressed and narrowed as it passes under the root of the mesentery   This is well shown in the wax casts of the duodenum made by Dwight,[1] and was recognized by Glenard,[2] who attributed to this constriction a physiological significance, namely, that it allowed of time for mixing of the food with the bile and pancreatic juice

Any factor which lessens the angle between the superior mesenteric artery and the aorta and vertebral column through which the duodenum passes, will tend to cause a greater or less degree of duodenal obstruction   A congenital abnormality in the relationship of the vessel to the duodenum might thus lead to a partial obstruction which, late in life, might become more acute from the introduction of some other factor   If such congenital abnormalities occur, then we should expect to find occasionally an aggravated instance of the trouble in early life   This has been shown to arise, as in the cases of megaduodenum recorded by Dubose [3] and by Downes,[4] where, in young children, enormous dilatation of the duodenum was found, up to the crossing of the mesentery, without any actual organic narrowing of the bowel being discoverable   In the cases met with in adult life, however, it is necessary to postulate some drag on the mesentery, which, acting intermittently, causes the 'attacks' from which the patient suffers

Two conditions producing such a drag have been demonstrated   The one is where the empty small intestines hang over the pelvic brim without resting on the floor of the pelvis when the patient is upright or in the dorsal recumbent position and where, from lack of tone in the abdominal wall the natural support to the viscera is lost   When the empty small intestines hang over the pelvic brim, the mesentery is folded like a fan and the drag is a uniform one in the vertical direction   The other condition is that of congenital lack of fixation of the proximal colon where the caecum and ascending colon prolapse into the pelvis and exert traction on the mesentery in the line of the superior mesenteric artery   Bloodgood[5] has demonstrated this condition, and has treated it by resection of the proximal colon

In one case presenting the symptoms of chronic duodenal obstruction in which the latter condition was present I found that the pressure on the third part of the duodenum was exerted by the right colic artery which crossed the duodenum in an almost vertical direction   This type of obstruction has I find also been noted by Gregoire [6] by Villette,[7]

and by Duval,[8] in cases with a floating proximal colon As might be expected, constipation frequently precedes the onset of the duodenal symptoms Sclerosis of the root of the mesentery following on inflammation probably associated with mesenteric glands may give rise to similar pressure on the duodenum This appeared to be the active cause of obstruction in a case recorded by Gregoire Personally I have not met with it Air-swallowing may tend to aggravate the condition, and certainly did so in one of my cases It is, however, a habit acquired from ineffectual attempts to relieve the flatulence by belching up wind, and has no primary etiological significance as Leveuf[9] would seem to indicate

Pathological Anatomy —The salient feature of the condition is the dilatation of the first three parts of the duodenum up to the crossing of the mesenteric vessels The dilatation is most pronounced in the first part of the duodenum, which may look like a second stomach The dilatation of this part may, however, be masked, or modified by the presence of the scar of a duodenal ulcer In three of my cases a duodenal ulcer was present, in another, a gastric ulcer The wall of the duodenum is hypertrophied, the degree varying in different cases In one of my cases it resembled the wall of the stomach when grasped between the finger and thumb The pylorus is usually dilated, in one case it admitted three fingers This is not invariable, however, and the maintenance of the tonicity of the pylorus may modify the clinical picture, as will be indicated later

The small intestines will, as a rule, be found empty and lying in the true pelvis On drawing up the small intestines by pulling on the mesentery, a feeling of resistance is encountered and the intestines will sometimes leave the pelvis with a 'pop In other cases it is the crecum and lower part of the ascending colon which occupy the true pelvis and offer resistance when an upward pull is applied to the mesentery If the duodenum is distended at the time of examination, and a finger be passed behind the root of the mesentery and the latter lifted forwards, the duodenal content will immediately pass on and fill up the duodenojejunal loop

Symptomatology —The patient is usually a female of somewhat spare build and of the visceroptotic type She gives a history of stomach trouble for many years, usually since childhood She will state that she has always had to be careful of what she ate, otherwise she suffered from epigastric pain and flatulence Periodically she has had bilious attacks, with nausea and vomiting At the age of thirty or thereabouts the symptoms become aggravated Epigastric discomfort and flatulence follow all but the simplest of meals Walking and standing aggravate these symptoms, rest in bed gives a certain amount of relief Some patients will volunteer that they have found that lying on the face or in the genu-pectoral position will give relief In addition to the chronic flatulent dyspepsia so suggestive of a biliary condition, they suffer from what they term their attacks These are the typical popular 'bilious attacks consisting of first, a day of headache and nausea and epigastric discomfort, sometimes amounting to actual pain, this is followed by vomiting first clear, then bilious This may last for a whole day, after which the patient feels completely relieved, although relatives remark that she looks hollow eyed and has a tinge of jaundice Such attacks tend to recur at intervals of four to five weeks and are ushered in by constipation In a few cases the nausea, headache, lassitude and epigastric pain are the most pronounced symptoms, and vomiting is an occasional and late symptom In such cases it would appear that a tonic pylorus resists the duodenal tension until it last it gives way bile regurgitates, is vomited, and relief is obtained The persistence of such symptoms over a prolonged period is apt to lead to a state bordering on if not actually of neurasthenia when the subjective symptoms completely masked of multiply by analysis and make diagnosis more difficult

Physical Signs —In a pronounced case examination of the abdomen may reveal a definite epigastric fullness This however will usually not be detectable When asked to indicate the site where pain is felt the patient will refer to a point about one inch above the umbilicus and usually slightly to the left of the mid-line At this area some superficial cutaneous hyperesthesia may be detected In some cases the seat of pain

is located to the right of the mid-line   Firm pressure by the examining hand from below upwards tends to relieve the pain   Should the duodenum be distended with gas at the time of examination, a definite tympanitic swelling may be made out above the colon This I have seen in one case, but it must certainly be unusual   Succussion will show the stomach to be dilated   Duodenal succussion I have never elicited

X-ray Examination—The evidence of such examination is variable, for, whilst definite retention of bismuth in the duodenum, and particularly in the most dilated first portion, is obvious in some cases, on the other hand no such delay has been observed in cases which at operation showed unmistakable signs of duodenal obstruction with dilatation   Could the patients be subjected to x ray examination during one of their 'attacks', one would doubtless obtain some more useful evidence   Marked ptosis of the cæcum and ascending colon may be shown by the rays, and may indicate the causal factor and the appropriate treatment

Treatment—As this condition is so often merely a complicating factor in viscero ptosis, treatment by rest with the foot of the bed elevated, massage, feeding, and, later, an abdominal support, and suitable exercises, may reasonably be expected to relieve the earlier and less pronounced cases   For the severer cases, and those in which medical measures have failed to give relief, operative treatment must be considered   This will be of two types   it will be directed either to removing the drag on the mesentery, or to short circuiting the obstruction   If at the operation the drag is obviously due to ptosis of an abnormally mobile cæcum and ascending colon, plication or fixation of these or both measures combined, will be indicated and will give relief   In two cases which I have treated in this way the results have been quite satisfactory   Bloodgood, in five cases of this kind, resected the proximal colon with a successful result

On the other hand, if the proximal colon is fixed and the drag is due to prolapsed small intestines or to some less obvious cause, or if the dilatation is so extreme as to have altered the relations of the third part of the duodenum, a short-circuiting operation is indicated and will undoubtedly give the most satisfactory result   The operation of duodeno-jejunostomy—making a lateral anastomosis between the third part of the duodenum and the first loop of jejunum—is both a safe and a satisfactory operation when the duodenum is dilated   With the transverse colon thrown upwards, the bulging third part of the duodenum rises into the wound   A transverse incision is made through the peritoneum covering it, and, by a little blunt dissection, the bowel is easily mobilized sufficiently to allow of an anastomosis clamp being applied   If a straight clamp cannot be satisfactorily used, a Brunner's angled clamp will prove useful (*Fig* 204)   The first loop of jejunum about seven inches from the duodenojejunal flexure, is brought alongside and similarly clamped, and a lateral anastomosis performed   In all the five cases in which I have performed the operation, interrupted linen sutures for the outer row, and catgut for the inner rows, of sutures have been used   Linen was used for the outer layers because I was not sure of the healing properties of the duodenal wall in its retroperitoneal part   This, however, has proved so satisfactory that I should not now hesitate to use catgut throughout At the conclusion of the anastomosis the upper cut edge of the peritoneum is stitched to the duodenum with one or more sutures (*Fig* 205)

After-treatment—Sips of water by the mouth and rectal salines for the first forty eight hours after which a steadily increasing diet has been given in all cases   The post-operative course has been quite uneventful in all five cases   no vomiting and less discomfort than after most abdominal operations have been the rule   At the end of a week, all the patients have expressed themselves as feeling better than for years *before* pain and discomfort having gone and appetite returned

Consequences of Chronic Duodenal Ileus—Stasis in the duodenum, besides leading to toxic phenomena, such as the headache nausea, and malaise associated with a bilious attack may by allowing bacteria to multiply be a source of infection to its own wall and to adjacent viscera which communicate with its lumen   The association of duodenal ulcer with chronic duodenal ileus is too frequent to be mere coincidence, and stasis in the duodenum must be registered as one of the predisposing causes of duodenal ulcer and as

a factor which may determine the gravity of a perforation (as in *Case* 2) and prejudice the success of the usual operative treatment of the ulcer (as in *Case* 3) The association of a gastric ulcer with duodenal ileus is one which I have met with, and, from the patient's long history, it appeared that the latter was the preceding condition The frequency with which so called acute gastromesenteric ileus has supervened after operation on the biliary passages has led more than one observer to ask whether a chronic duodenal obstruction was not present before the acute obstructive symptoms supervened

The escape of duodenal contents through a biliary fistula in a case of bilious vomiting after an operation on the common bile duct demonstrated to me the possibility of duodenal obstruction leading to infection of the biliary passages Similarly, the finding of marked dilatation of the duodenum at a post-mortem on a fatal case of acute hæmorrhagic pancreatitis suggested that duodenal stasis might have led to the entrance of infective duodenal contents into the pancreatic duct, and activation of the pancreatic ferments

These are questions, however, on which much more evidence than I can furnish must be brought forward before any conclusions of value can be drawn

Relation of Duodenal Obstruction to Vicious Circle after Gastro enterostomy — Among the numerous causes of disappointment after gastro-enterostomy cited by Moynihan,[10] this condition finds no place None the less I am convinced that it is one of the common causes of trouble, and particularly of regurgitant vomiting after that operation Most surgeons can recall cases in which, under the diagnosis of duodenal or gastric ulcer, the abdomen was opened and no ulcer found, but possibly some dilatation of the first part of the duodenum noted, and in which a gastro-enterostomy was performed All surgeons are unanimous now that the operation in such cases was a mistake, familiar as they are with the frequency of its post-operative troubles When the question of re operating in such cases is raised, the possibility of duodenal ileus should be kept in mind and the advisability of a duodenojejunostomy considered Moreover, even although a duodenal or a gastric ulcer be present, if, in the history of the case, long-standing flatulent dyspepsia with attacks of vomiting be prominent features, and if, at the operation, unmistakable dilatation of the duodenum be present, the advisability of a duodenojejunostomy, either alone or along with a gastro-enterostomy, should be seriously thought of

In one of my cases, in which the history of pain and discomfort extended over thirty years, and in which the duodenal dilatation was extreme, there was a well-marked gastric ulcer on the lesser curvature of the stomach A duodenojejunostomy was performed, and the ulcer was left alone The patient's pain, which had been pronounced, and all the other symptoms, disappeared after the operation, and she has remained well

I have purposely considered the whole question of duodenal ileus as it has presented itself to me Since making most of those observations I have discovered that both in America and in France other observers have reached conclusions almost precisely the same Thus, Finney,[11] Stavely,[12] Codman,[13] Bloodgood, Spence and Graham,[14] and Kellogg[15] have all recognized the condition and treated it on similar lines Kellogg,[16] indeed in a recent article, reports over forty cases in which he has done the operation of duodenojejunostomy The operation was first suggested by Barker in 1906, and was first performed by Stavely in 1908 In France, Duval, Delbet,[17] Gregoire, Villette, Savariaud[18] Kotereff,[19] and others have recently reported cases some of which were successfully treated by duodenojejunostomy From Australia, Devine[20] reports three cases successfully treated on similar lines Without entering into any analysis of the recorded cases, one may state that the clinical picture and operative findings in all coincide with and confirm the observations which I have made, and strengthen my conviction that we are here dealing with a pathological and clinical entity In this country the condition has so far as I am aware, received practically no attention, and this paper is published with the object of directing attention to the recognition and treatment of a class of case which has hitherto defied surgical treatment

CONCLUSIONS

1 Chronic duodenal ileus from compression of the third part of the duodenum by the root of the mesentery is a clinical and pathological entity

2 It may be associated with duodenal or gastric ulcer, and with biliary and pancreatic lesions

3 Visceroptosis, and congenital lack of fixation of the proximal colon, predispose to its development

4 Fixation of the proximal colon may relieve certain cases

5 Drainage of the dilated duodenum by duodenojejunostomy is the most certain method of treatment, and the only one suited for well-developed and late cases

6 Acute dilatation of the stomach, either idiopathic or post-operative, is probably merely a gross manifestation of a previously present chronic condition

I wish to express my thanks to Mr J W Dowden for his kindness in allowing me to study the pathology and to publish the notes of *Case* 3, which was under his care, and to Mr J N J Hartley for his assistance and helpful advice in the study of some of these cases

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TESTICULAR SYMPTOMS IN APPENDICITIS

By ZACHARY COPE, London

So far as I am aware, the testicular symptoms in appendicitis have never claimed more than a casual notice in even the most exhaustive treatises on the subject of appendicular disease   Most writers do not seem to be aware of their occurrence   Yet the subject is of considerable importance, for misdiagnoses may result from lack of appreciation of the symptom

Testicular pain or discomfort occurs in probably about 5 per cent of the cases of appendicitis occurring in the male   The pain is often not so severe as the general abdominal pain, and may not be complained of by the patient unless he be directly questioned on the point   The pain is either a dull aching or of a sharp shooting nature

ILLUSTRATIVE CASES

Case 1 —A medical man, age 27, who was known to have a mobile right kidney, was one morning seized with rather vague pain in the hypogastrium and dull pain in the testicles   There was no vomiting, but acute loss of appetite, and nausea   Flatulence and discomfort were experienced in the right renal region   The patient himself thought that he was suffering from a Dietl's crisis, and this opinion was concurred in by a surgeon who saw the case within eight hours of the onset   After rest in bed for a week the symptoms abated, an abdominal belt with special renal pad was ordered, and the patient allowed to go away to the seaside   A week later he noticed a rather tender lump in the right iliac region, and felt the renal pad irksome   Thinking the kidney might have become displaced again, he returned to town, where his temperature was found to be 101°   Examination revealed a fluctuant swelling, and a large appendicular abscess was successfully drained   The patient later extruded a concretion from the sinus left after drainage   When appendicectomy was undertaken a month later, only the stump of the appendix was found attached to the cæcum

Case 2 —B S , a man about 30 years old, was taken with vague right sided abdominal pain, May 12, 1914   During the night the pain became much worse, and he vomited   When I saw him at 6 30 am on the 13th, there was pain on pressure at the right erector-costal angle, and some rigidity of the anterior abdominal muscles on the right side   He complained that the pain went down into the right testicle, and that the day previously his urine had been dark-coloured   Provisionally I diagnosed renal colic, gave morphine, and arranged for an x ray photograph to be taken   The radiogram showed a shadow just external to the line of the ureter which the radiologist said was probably a calcareous gland   In view of the symptoms I thought this might be a stone in the ureter   and after cystoscopy I explored the right ureter by open incision   The ureter was quite normal, but on opening the peritoneum at the anterior part of the wound I found and removed an acutely inflamed appendix—non adherent and unperforated—with a calcified gland the size of a hazel nut embedded in the appendicular mesentery

Case 3 —Mr G   History of five days illness with abdominal pain, vomiting, fever, and abdominal distention   No trouble with micturition, but had some pain in the *left* testicle   I opened a large pelvic abscess on the sixth day of the illness

Case 4 (not under my care) —H C , age 26   History of abdominal pain, first epigastric, then right iliac   Pain also radiated to the right testicle   Neither vomiting nor nausea   Two days later pain still in right iliac fossa and right testicle   Operation revealed a gangrenous appendix in the right iliac fossa

Case 5 —Mr D   age 58, at 11 am on the morning of Feb 20, 1921, felt a severe pain in his left testicle   For an hour and a half this pain was unaccompanied by any other symptoms but at 12 30 there ensued generalized abdominal pain   Later, the pain settled in the right iliac region   There was more pain but no nausea or vomiting   Two days later, when I saw him, there was definite evidence of abscess formation in the right iliac fossa   I opened the abscess, and removed a perforated appendix lying on the iliopsoas muscle   There was a concretion in the appendix, and the appendicular mesenteric vessels were thrombosed

In all these recorded cases the testicles showed no sign of local inflammation or disease   I have seen at least two other cases, but these five serve to illustrate the main facts, which may be summarized as follows —

Pain in either the right or left testicle, or in both testicles, may accompany acute appendicitis   This pain is due to the appendical disease, and is not dependent on any disease of the genito-urinary system

Though the testicular pain is usually associated with perforation of the appendix, it may accompany appendicitis without perforation (*Case* 2)

The testicular pain may precede the onset of the abdominal pain by at least an hour or two, though this is unusual

The duration of the pain may be short or as long as two days

Cause of the Pain —Whilst it is tempting to suggest that direct irritation of the sympathetic nerves accompanying the spermatic artery may account for the testicular pain, yet the facts that the pain may be on the left side, and may occur with an unperforated appendix, negative that explanation for at least some of the cases

The sympathetic nerve supply of the testicle is from the tenth spinal cord segment, whilst fibres from the first lumbar go to the cord and cremaster   I believe there is clinical evidence to show that the appendix is supplied chiefly from the tenth spinal cord segment May the testicular pain not be explained most easily as a pure referred pain, since the appendix and testicles appear to be supplied by the same cord segment

When a pelvic abscess has formed, possibly direct irritation of the vasa deferentia or seminal vesicles might cause testicular pain

Retraction of the Testicle is occasionally noted in appendicitis   This may be due to irritation of the genitocrural nerve causing a contraction of the cremaster

As evidence of the importance of the testicular symptoms in appendicitis, one need only read the account of the first two cases, where renal conditions were diagnosed in consequence of the pain in the testicle   In one of these the correct diagnosis was not made till a large abscess was detected a week after the onset of the illness

FRACTURE OF THE HUMERUS IN AN INDIVIDUAL WITH OBSCURE BONY LESIONS.

By C E HUGHES, Manchester

This case is put on record with the hope that, in the light of further knowledge, a more satisfactory interpretation of the bony lesions described may be forthcoming than is given here

The patient, age 55 years, a foreman plumber by occupation, boarded a slowly-moving tram-car in Manchester in January, 1921 To gain the platform he grasped the vertical hand-rail of the car with his right hand and sprang on to the lower step In doing so he experienced a sensation as though the rail had given way, and on releasing his hold the arm fell to his side and he realized that it had
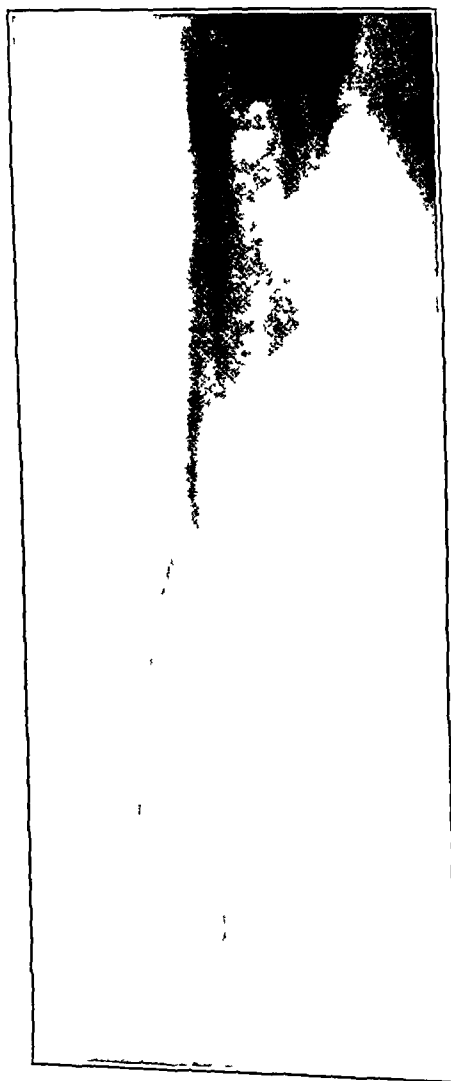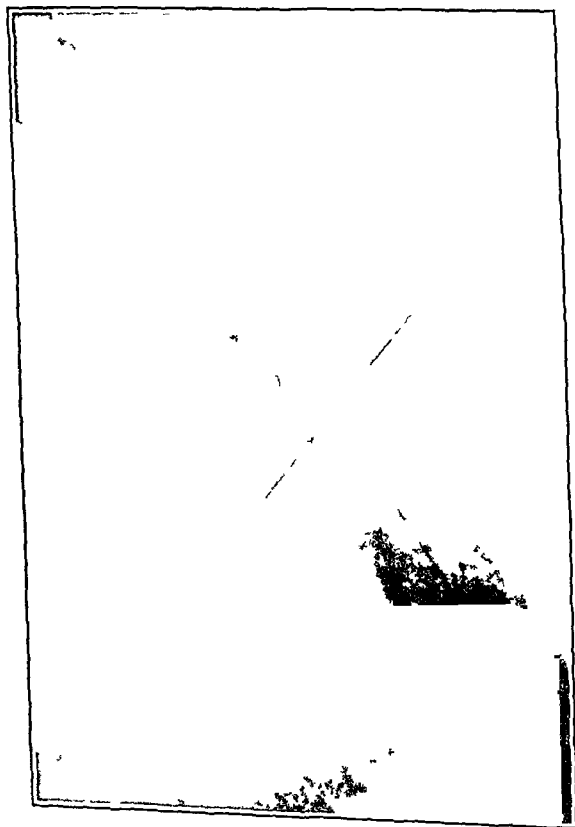
Fig _07 —Left humerus showing cystic disease and periosteal new bone formation

sustained some injury   The car took him past the Central Branch of the Manchester Royal Infirmary, where he alighted to seek treatment   A fracture of the right humerus was diagnosed, and confirmed later by a radiograph (*Fig* 206), and on 15th January he was transferred to the out-patient department, where he first came under my notice

My first impression was that there was a pathological fracture occurring in a humerus the seat of a new growth, possibly a secondary carcinoma   An examination was therefore made of those organs carcinoma of which is specially liable to produce metastases in bones   This examination gave a negative result   A request was then made for a radiograph of the *left* humerus for purposes of comparison   The receipt of this radiograph (*Fig* 207) led naturally to a more extensive examination of the osseous system, and further radiographs were taken (*Fig* 208 to 210) after a preliminary screening suggested by Dr J B Higgins

Meanwhile a history of syphilis (chancre) thirty years previously, and for which he was treated with medicine for a couple of years, was obtained , and a Wassermann test

FIG 208 —Upper end of left humerus showing extensive cystic disease

was returned as being positive in 1—40 dilution   The patient showed no collateral evidence of syphilis, external examination of the bones gave no indication of any underlying disease —the man himself complained only of a little rheumatism in the left shoulder—and the urine was normal

The subsequent history may be stated briefly   The fracture united well in a normal fashion, immobilization was entirely discarded at the end of fourteen days, and a course of massage and movements instituted   At his own request the patient returned to his work, which involved no manual labour, a month after the accident   At the present time, two months after the accident, the limb is fully functional

Observations —1 *The Fracture* —The etiology of the fracture is of some interest Although I am now of opinion that it was caused by muscular contraction, I do not think that the pathological condition of the bone can be altogether disregarded   It is unlikely that such an accident would occur to a normal bone, and I therefore consider that the pathological condition of the bone is to be regarded as a strong predisposing cause   The

obliquity of the fracture also is a point in favour of an exciting cause by indirect violence which in this case, I take it, is muscular contraction

2 *The Bony Lesions* —In endeavouring to elucidate the etiology of a number of lesions in the same individual, one invariably seeks a common cause In this particular case it may be that syphilis is the sole causative factor, but there are difficulties in effecting a total reconciliation
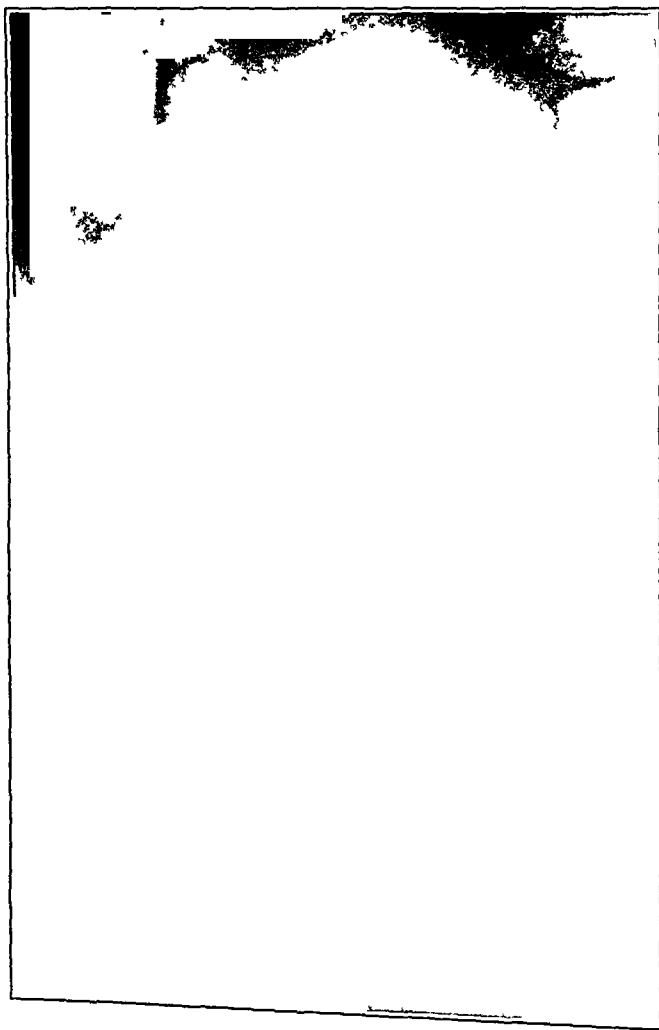
FIG 209 —Right femur and ilium showing rarefaction (? cystic condition) of great trochanter periosteal thickening with tendency to formation of cyst of femoral shaft, and cystic disease of ischium

FIG 210 —Right tibia and fibula showing fibrous hyperplasia of fibula

The lesions may be roughly grouped as follows —(1) Fibrous hyperplasia, seen in the right fibula (2) Cystic degeneration, seen particularly in the left humerus and also in the right humerus right ischium and both femora , (3) Periosteal new bone formation, seen especially in the right ilium and right femur , (4) Atrophy of the compact bone of the right humeral shaft

The first and second groups strongly suggest osteitis fibrosa and osteitis fibrosa cystica respectively These diseases are possibly related to syphilis, although the relation has

not yet been definitely established   The absence of any bending of the affected bones is a noteworthy feature

The question of new growth has been considered, but as already stated, no extraneous malignant disease was found, and the rapid union of the fracture disposes of the possibility of a primary malignant growth of bone   Absence of an albumosuria disfavours a myelomatosis

The third group is probably of syphilitic origin, but I am at a loss to account for the atrophy of the right humeral shaft

The patient is now undergoing a course of salvarsan treatment, and it will be interesting to observe to what extent, if any, these lesions show a disposition to change

NOTE ON A SERIES OF 100 OPERATIONS FOR GALL-STONES IN PRIVATE PATIENTS: WITH SPECIAL REFERENCE TO RECURRENCE

By Sir GILBERT BARLING, Birmingham

In February last I was asked to see a lady, age 74, upon whom I had operated some years previously for gall stones in the gall-bladder and common duct The gall-bladder was removed, the duct cleared of soft, mortar-like stones washed out and drained A good recovery followed, and the patient remained perfectly well for nearly six years when she experienced a severe attack of pain in the upper abdomen, without vomiting and this was followed by jaundice in a day or two After a few days in bed the jaundice quickly diminished, and the patient was allowed to get up but a return of pain followed, with increase of jaundice, again without vomiting I saw the patient on this occasion and found her moderately jaundiced and with some tenderness over the tail of the pancreas She described her attacks of pain as a bad stomach-ache, and is different from the pain of her old attacks of colic I thought it probable that her recent illness was due to pancreatitis rather than to recurrence of stone in the common duct When I saw the patient again she had suffered attacks of pain with vomiting, which in the opinion of her medical adviser, Dr Starkie, were fairly typical of gall-stone colic

At the second operation, on May 22, exposure of the common duct was fairly difficult owing to old extensive adhesions, the duct was occupied by masses of soft ill-formed stone, it was cleared, syringed out, a large bougie passed into the duodenum, and a good recovery followed

The experience of this patient induced me to undertake an inquiry into the subsequent history of gall-stone cases, and for this purpose I have investigated the history of my last 100 cases operated upon in private, the difficulty of obtaining subsequent history from hospital cases being too great

Of the 100 cases, 6 died as the result of the operation, or of conditions present which were beyond control One patient, a male, age 31, a mentally defective, had a perfectly simple operation for stones in the gall-bladder only, there was little manipulation and the gall bladder was drained I did not see the patient again, but was informed that for six days progress was perfectly satisfactory, and then a condition set in which was ascribed to acute myocardial failure, and the patient died in three days The second death was in a lady of middle age, upon whom I had operated seven years previously for intestinal obstruction arising immediately after parturition To relieve the obstruction, which was due to growth in the transverse colon, a colotomy was performed Twelve days later, when I proposed to remove the growth, I found on re-opening the abdomen that in addition to the carcinoma which was the actual cause of the obstruction, the colon was the site of widespread papillomata, and it was necessary to excise the colon from the cæcum to the sigmoid flexure, these two portions being then united by lateral anastomosis The patient remained well for six years, and then suffered symptoms of gall-stone, for which I operated in April, 1918 I do not remember that I have ever had greater difficulty in finding the gall-bladder adhesions of the densest character existed everywhere, and the organ itself was very shrunken Stones were removed from it and from the common duct Around the latter there was a collection of pus In the later stages of the operation some large vein was torn, either the portal or one of its immediate tributaries Much blood was lost in trying to secure this, and

eventually I left forceps on, but hæmorrhage recurred, and from this the patient died Looking back on this, I wonder whether I should have done better to persist in my endeavour to tie the vessel in a patient profoundly shocked by a severe and prolonged operation and loss of blood   In one other case in which I had similar difficulty, the closure of the vessel by forceps was carried out safely   The remaining deaths were in patients very undesirable subjects for any operation   One, a male, age 68, gouty and alcoholic, with stone in the common duct, rigors and high temperature, died on the fifth day after operation   The second, a doctor, age 58, alcoholic and deeply jaundiced, had stones in the gall-bladder, a greatly dilated common duct from the pressure of a chronically inflamed pancreas, and also severe cirrhosis of the liver, he died on the following day   The third, a male, 60 years of age, the subject of gall stone attacks for ten years, with recent severe illness associated with high temperature but free from jaundice, had suppuration around his gall-bladder, and died in a few days from a spreading peritoneal infection   The fourth patient was a feeble elderly lady with stone in gall-bladder and common duct, and she died from shock on the day following operation

On looking over the table of the 100 cases, the most striking feature is the more frequent removal of the gall-bladder as an alternative to draining it in the later cases of the series   In the last 50 cases, the gall-bladder was removed in 40, but in the first 50, removal was effected only in 13 cases   I suppose that my practice of removing the gall-bladder as a routine procedure now, is similar to that of other surgeons   There is much to be said for the practice, always an infected organ in the presence of stone, I doubt if it is ever freed from infection by draining it, thus conditions remain which caused formation of stone in the first instance   The absence of the gall-bladder appears to me as little harmful as the absence of the vermiform appendix, but other cases similar to that described at the commencement of this note have occurred in my practice, and give occasion for thought, and to this point I return later   One thing perfectly clear in my mind is that patients recover more easily and quickly if the gall-bladder is removed rather than drained, there is less likelihood of infection of the abdominal wound, and the scar is firmer   At first rather conservative in removing the organ, fearing that it implied some additional risk, I have now arrived at the conclusion that removal does not add to the risk, excepting in such conditions as I am about to mention   In my later cases abstention from removal has been due to widespread suppuration round the gall bladder, to the desire to shorten the operative measures in feeble patients—as for instance those with extensive pancreatitis—or to the fact that the patient has given rise to anxiety with regard to the anæsthetic

In one patient whose gall-bladder had been removed by another surgeon, I had to perform gastrojejunostomy for the relief of pyloric obstruction due to dense adhesions puckering the pylorus into the bed formerly occupied by the gall-bladder, a warning that every precaution should be taken to cover with peritoneum any raw surface   In four patients whose gall-bladders were not removed, the stones had ulcerated through, and lay in a collection of pus adjacent

Of the 100 patients, 35 had stone in the common duct, and many of them had pancreatitis   sometimes this was very limited and quiescent, but in a few the involvement was extensive, and associated with fat necrosis   One patient, a male, also had stone in the head of the pancreas, and gave much trouble owing to the digestion of the wound edges by the pancreatic secretion   this ended in a large ventral hernia   In two cases it was necessary to open the duodenum for stone impacted in the ampulla, both recovered and have remained well since   One patient, who had suffered from typhoid fever eighteen years before, and whose gall-bladder was removed provided a pure cultivation of *B typhosus* and her blood what was described as a fading Widal reaction   So far as could be traced she had not infected other people   As a general rule when operating for gall-stones, I remove the vermiform appendix, and on two occasions in the hundred cases I also performed gastrojejunostomy *for severe stenosis* due to duodenal ulcer

In the 100 cases the gall-bladder was drained in 47 of these, 5 died, leaving 12 for investigation   In one, a young married woman, symptoms recurred in a few months, when I removed a typical strawberry gall-bladder, which would have been excised at the first operation but that she gave rise to much anxiety from the anæsthetic   In one a sinus remained for months, then healed and again broke out, when the gall-bladder was removed by another surgeon during my absence from England   this was one of the patients in whom stones had ulcerated through into the abdominal cavity lying in a collection of pus, and I was desirous of reducing the manipulations to a minimum   In one patient symptoms returned soon after the operation, and further operation was refused , in one other, symptoms recurred some years after operation in 1912, but no further operation has been required

Of the 53 cases in which the gall-bladder was removed, 1 died   Of the remaining 52, 3 have had symptoms suggesting further formation of gall-stones   the case related at the beginning of my note is one of these   A second was in a lady, residing now in South America, who wrote to me five and a half years after her operation saying that she had a return of symptoms with jaundice, but I have not been able to trace her since The third, a male, remained quite well for five and a half years after his gall-bladder was removed, then he had a severe chill due to exposure to wet, which was followed by discomfort in the epigastrium, and jaundice   These conditions were associated with fullness and tenderness over the pancreas , the symptoms diminished, and then intensified over a period of three to four months   there was no definite attack of colic   Eventually the patient recovered completely, and he has remained well for fifteen months   My diagnosis was pancreatitis

That stone may recur after removal of the gall-bladder is proved by my notes, and I may refer to a hospital case in which when removing a much-deformed gall-bladder, I pulled up and ligatured the common duct   For some months the whole of the bile discharged through the wound , the abdomen was then re-opened   with great difficulty both ends of the common duct were found, with a gap of half an inch between them   the parts of the duct were freed, and the ends sutured around a decalcified bone drain   No drop of bile escaped after this, but three years later the patient returned with jaundice and symptoms suggesting further stone   The abdomen was re-opened   and one stone removed from the common duct , but the point where the duct had been reunited could not be recognized

CONCLUSIONS

1 Removal of the gall bladder rather than draining it should be the routine procedure

2 An easier and safer recovery follows

3 Removal of the gall bladder does not prevent recurrence of stone in the common duct   but I see no reason to believe that it adds to the likelihood of recurrence

CYSTIC DISEASE OF THE FIRST RIB CAUSING LOWER-ARM (KLUMPKE) TYPE OF PARALYSIS

By W. C. B. MEYER, London

History —Patient was a man, age 52, complaining of   (1) Swelling in the left supra clavicular region , (2) Wasting of the left hand , (3) Numbness of the inner side of the forearm and hand , (4) Pain behind the left shoulder and down the inner side of the left arm and elbow

1   The swelling appeared gradually and painlessly four years ago   The patient was rather vague about some blow sustained during rifle drill   The tumour increased to its maximum size, namely that of a Tangerine orange, in about six months, and then remained stationary

2   The wasting of the left hand was noticed about a month later, after weakness of this member had attracted his attention   Slowly the inner two fingers stiffened and contracted, and his hand became somewhat clumsy , but he never lost the power of bending his fingers or his wrist

3   The numbness of the inner side of the forearm and hand appeared some considerable time after the weakness and wasting

4   Pain behind the left shoulder and down the inner side of the left arm and elbow was his main complaint   He first had some pain about eighteen months ago, which slight at the beginning gradually got worse until, two months before operation, it caused him to lose sleep   It was most severe in the mornings, which he attributed to a sub conscious habit of assuming a left-side position in sleep   The pain was of a stabbing or shooting neuralgic character, and though it originally went down his forearm, subsequently it got no further than his elbow, where it remained all day   Pressure against the left shoulder in leaning against anything brought on pain along the inner side of the upper arm, which was rendered so irritable that he could not bear even his shirt to touch it

Examination —

1   A tumour was revealed, in size and shape rather like a Tangerine orange, between the posterior border of the left sternomastoid and the anterior border of the trapezius its lower margin encroaching over the clavicle superficially   It was soft, non-fluid, non pulsatile, with a smooth surface, presenting three or four distinct lobulations, and with a very clearly-defined edge   It moved remarkably freely in all directions, was subcutaneous and the skin moved easily over its surface

2   The left hand was typically ape like, with marked wasting of both median and ulnar intrinsics, with contracture of the little finger and, to a lesser degree, of the ring finger   The joints of these two fingers could not be straightened   The skin over the ulnar area of the hand and of the lower third of the inner aspect of the forearm was some what blue, dry, and rough, and thickened over the palm   There was slight general wasting of the whole of the left forearm, and more marked atrophy along the inner border There was no interosseal movement of the fingers, but he could strongly flex these and the wrist   On testing sensation before operation there was both protopathic and epicritic loss right up to the elbow along the ulnar side of the forearm and over the ulnar fingers (inner 1½)   The photograph (*Fig* 211) shows the sensory chart some four weeks after operation

3   There was no change in the radial pulse when the arm was raised and depressed

4   There was definite paralysis of the cervical sympathetic, as shown by a markedly

constricted pupil, slight enophthalmos, and absence of cilio-spinal reflex on pinching the neck.

The x-ray (*Fig* 212) showed—

1 The left first rib—more particularly its posterior half—to be full of cystic spaces and the rib itself to be expanded and irregular in outline

2 The left transverse process of the first dorsal vertebra to exhibit the same cystic change

3 In addition to the shadow cast by the superficial tumour, one due to a second deeper tumour involving the area of the cupola of the pleura

Dr Acland's clinical report on the apex of the left lung was   "There is no evidence of any involvement of the lung   Dr Levick's report on the electrical reactions of the
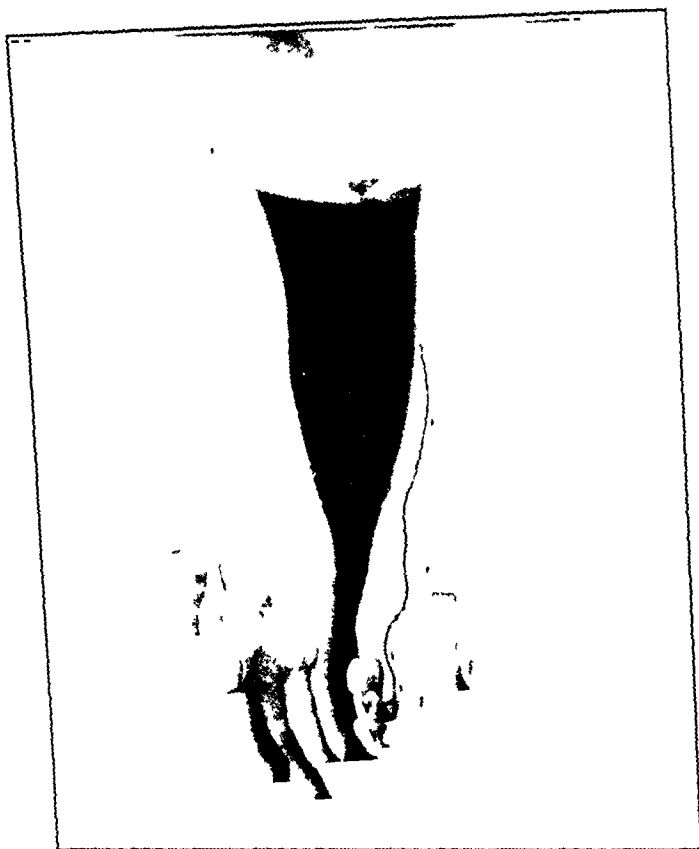
Fig 211 —Photograph of patient, illustrating   (1) Ape hand and contracture of ulnar fingers
(2) Area of sensory loss four weeks after operation

muscles of the hand was   " Interruption to the nerve supply of all the intrinsics of the hand except the adductors of the thumb "

Diagnosis —The chief interest of the case lay in the diagnosis   Obviously there was pressure causing almost complete physiological interruption of the first dorsal nerve-root—the only evidence of incompleteness being some faradic response in the adductors of the thumb   The eighth cervical root was also suffering from pressure, because the wrist flexors, though not completely paralyzed, were wasted and weak   The second dorsal nerve showed irritative sensory pressure signs, namely pains down the inner side of the upper arm as far as the elbow, and pains referred to the back   Again, it was clear that either the expanded first rib or the deep tumour, or both together, could cause these pressure symptoms

But what was the nature of the disease which would cause multiple cystic expansion of a rib and a portion of a vertebra and in addition produce two tumours, the superficial one of which had all the clinical features of a subcutaneous lipoma ? It was not *chronic inflammatory*, for tubercle, syphilis, and actinomycosis could be excluded on x-ray evidence alone, and fibrocystic disease of bone would *not explain the extra* osseous tumours   A *neoplastic* origin of the bone condition could only be explained by a myeloma rupturing through a thinned bony capsule, and infiltrating the surroundings , but a pulsating irregular and more deeply-seated tumour would then have resulted   No malignant tumour could have furnished the clinical picture presented   Among *parasitic* conditions producing cysts in bone, that due to the *Tænia echinococcus* was considered, but since on the one hand the supraclavicular tumour was so mobile on the deeper structures, so lobulated, so semisolid and nonfluctuant, and since on the other hand the patient had never come into close contact with dogs, this diagnosis did not seem to explain all the phenomena

FIG 212 —Skiagram illustrating   (1) Cystic 1st rib   (2) Faint outline of the superficial tumour
(3) Outline of deep tumour displacing pleura

The operation, done by Mr R C Elmslie established the diagnosis of *hydatid disease of the first rib*, the superficial and deep tumours being connected with the rib by perforations in the expanded bone   The superficial tumour had a long narrow pedicle leading to the first rib, while both tumours were filled with a thick creamy substance, which closely resembled the sebaceous secretion of dermoids, but was entirely odourless

The Operation—An incision was made parallel to the anterior border of the trapezius   The superficial tumour was found to have two sheaths, the outer apparently being derived from stretched deep fascia of the neck , the inner was very delicate, and formed a narrow pedicle dipping deeply between the scalenus medius and anticus to communicate with a perforation in the bone   On approaching the first rib, dissection ruptured this membrane, and the wound became filled with a large amount of the sebaceous like, curdy debris   The external respiratory nerve of Bell was sought for on the scalenus medius, and the union of its two upper roots was retracted back   The rest of the brachial plexus lay in front, and was retracted forward   The scalenus medius was stripped from

the rib, exposing three perforations in the greatly expanded bone. Through these perforations quantities of the same curdy substance exuded. As much of the rib as could be reached was removed posteriorly by means of bone-cutting forceps, and interiorly the rib was divided below the subclavian artery. The interior of the ends of the bone was scraped with a sharp spoon. Removal of the expanded portion of the rib exposed the deep tumour which had displaced the apex of the pleura. Its capsule, bounded by thickened pleura below and internally, by the upper two ribs externally and behind, and by the scalene group above, was scraped. Among the debris from the lower and deeper tumour were found five or six transparent round and ovoid exogenous hydatid daughter cysts the size of beans. The wound was drained for four days and then healed by primary intention.

Pathological Report, BY DR H. A. HAIG.—' Daughter cysts of varying size present from these scolices of *Tænia echinococcus* were obtained. Fluid in cysts contains numerous cholesterin crystals.'

After-result.—Five months later the patient had protopathic and some epicritic sensation in the whole of the previously anæsthetic area, and complete relief from pain. There was faradic response in all the intrinsic muscles of the hand except the opponens and flexor brevis pollicis, the fourth dorsal interosseous, and the abductor minimi digiti. There was also return of the cihospinal reflex.

TUBERCULOSIS OF THE FLAT BONES OF THE SKULL

By VALENTINE ST JOHN, Transylvania

This affection was until recently considered to be a rare one, if we are to judge from the scant attention given to the subject in our text books, and individual experience will be found to support this view   None the less a good many cases have been reported of late and Pelletier in 1910 collected statistics of 206 cases presumably from all sources   The maximum number of cases observed in a limited period of time are those published by Wieting and Raif Effendi, under whose notice there came ten cases within twelve months   In twenty years I do not recall having seen a single case, and yet in 1919 and 1920 no less than four came to me for treatment   This paper is founded on the experience derived from the observation and treatment of these cases, of which the first two have already been published in a foreign journal [1]

Tuberculosis of the flat bones of the cranium is in the majority of cases associated with obvious tuberculous lesions in other parts, and, as would be expected, more particularly with lesions of bones and joints   Pelletier regards the association as constant, while Wieting and Raif Effendi have reasons for considering cranial tuberculosis as frequently solitary   Of the four cases reported below, two had multiple tuberculous lesions, one had pulmonary tuberculosis, and of the fourth all that can be said is that extracranial lesions were not noted while the patient was under observation

Children and adolescents are more frequently affected than adults   Two of our cases, however, occurred in adults, and Lenoirmant's [2] two patients were also adults   In Pelletier's paper it is noted that, of 161 cases, 128 occurred before the twentieth year, 19 between twenty and forty, and 14 after forty

The bones most frequently attacked are the frontal and parietal, and a long way behind these come the temporal and occipital   Two forms of the disease are generally recognized, the one represented by a localized necrosis, known as the *perforating* form (Volkmann, Gangolphe), the other by a *diffuse progressive infiltration* (Koenig)

The number of perforations which may be found in the first form is very variable   Roger [3] has recently given a description of a solitary perforation found in the course of a post mortem examination, and Bergmann considered a single perforation to be the rule although he counted seven in one case   Menard records having found no less than twenty-nine perforations of the skull in a child   But it remains to be seen of what significance the perforations are

It has been the custom to regard each perforation as representing a separate focus This is certainly a mistake   In a previous publication on the subject I expressed my doubts as to the actual existence of two separate forms of tuberculosis of the cranial vault, in spite of the distinction having become almost classical   My opinion was that the conception of two separate forms was the result of an erroneous interpretation of pathological findings, the consequence largely of incomplete observations   To quote a passage from the publication referred to   ' Is not Menard's case an example of the diffuse tubercular variety, presenting simply an exceptional number of perforations, which nevertheless may not be out of proportion to the extent of the disease ?   And does not the subject of our first observation, whose skull was infiltrated to a remarkable degree presenting a large granuloma and numerous perforations, belong to the same class ' Without pretending to say the final word on a pathological subject of which the best of us can have only a limited experience, we may venture to express the opinion that the two forms described merely represent two distinct stages in the evolution of tuberculosis of the cranial vault

To my satisfaction I find this view in some measure endorsed by Cnormant, who writes, no doubt with Menard's case in mind "We must clearly distinguish, when we find abscesses, fistulæ, or multiple perforations at a distance one from the other, between cases where there are really independent and completely separated foci, and those — probably the more frequent — where these abscesses or fistulæ are only the outward expression, at divers points on the cranial vault, of a vast focus, diffuse and yet unique having its seat in the diploe or between the bone and the dura I Cnormant objects to the term 'perforating', and suggests very rightly that we should recognize only a circumscribed and a *diffuse* form Further observation will, no doubt, establish the fact that *there is but one form of tuberculosis of the cranial vault, circumscribed in its early stages and diffuse in the later*

It is generally admitted that the disease commences in the cancellous tissue of the diploe, an opinion which is supported by what we know of the origin of tuberculosis of bone in other parts Our cases entirely corroborate this view Theoretically we can recognize an early stage when the process is limited to the diploe, but sooner or later it attacks the outer or inner tables, or both Some observers seem to think that the disease spreads more rapidly through the inner table than the outer, but our cases do not bear this out In *Case 1* we gained the impression that the outer table was somewhat more widely affected than the inner, and in *Case 3* we found a single perforation going down to the dura mater, the outer table, however, being destroyed much more widely than the inner, suggesting that the disease had advanced more rapidly in the former Isolated cases of tuberculosis limited to the outer table, or to the inner — a fact more difficult of demonstration — have been reported, but they are rare *Case 2* of our series might be considered to illustrate the former, though its special features, perhaps place it outside this category *Case 4* is commented on later

But let us follow out the further evolution of the disease As mentioned above, the process has a tendency, while spreading in the diploe, to attack here and there the tables of the skull There are points at which both tables are invaded simultaneously, so that a single sequestrum is found involving the whole thickness of the bone Bergmann's case affords evidence of this He found in the midst of a tuberculous granuloma a fragment of the bony wall of the skull measuring 10 mm in diameter, in which were recognizable portions of both tables, including between them diploe infiltrated with caseous matter It is thus seen that the sequestrum can be eliminated spontaneously But the process of elimination must be tedious when the disease advances more rapidly in the inner table, for the sequestrum is then said to become wedge-shaped, having its base formed by the inner table As a rule the sequestrum disappears through a process of disintegration, so that at the operation we find either a complete perforation or an orifice containing the friable remains of the disintegrated sequestrum

But even before the sequestrum is eliminated or destroyed, the pathological process can reach the outer surface of the skull and give rise to a cold abscess This will at first be subperiosteal, and may at this stage form a more or less resistant tumour, being subject to some pressure as it lies between pericranium and bone The next step will be the perforation of the pericranium at some point and the outflow of pus into the lax cellular tissue beneath the scalp The anatomical conditions now allow the pus to occupy a wider space, and, the tension having been relaxed, the tumour becomes softer and more distinctly fluctuating Sooner or later the integuments will ulcerate if the abscess is left to itself, it contents will be evacuated, and there will form a fistula, which in no way differs from tuberculous fistulæ elsewhere While exploring with a probe we may come upon denuded bone, which can only be the sequestrum, for the bone in its immediate neighbourhood is invariably smooth and to all appearance normal, on the other hand, if the sequestrum has disappeared, the point of the probe may become engaged in a perforation of the outer table and be stopped by the inner

Let us now trace the progress of the disease inwards The inner table may become invaded in a similar way to the outer, and this may or may not take place at a point opposite to the site of the necrosis in the latter, though this is frequently the case The

bone tissue becomes destroyed, the dura mater is exposed and becomes the seat of an external pachymeningitis It becomes thickened and covered with granulations, which may extend in the subdural space well beyond the limits of the bony necrosis If the perforation thus involves the whole thickness of the skull, the point of the probe may abut against the thickened dura, which presents a more or less elastic resistance It frequently happens that this thickened dura no longer pulsates

It is very unusual to find a cold extradural abscess that has formed *in situ* But of course there is no reason why a cold abscess formed on the outer surface of the skull should not communicate through a perforation with the subdural space

Having traced the process outwards and inwards, let us see how it spreads in breadth

We have noted that the disease may extend over a considerable area of the skull, and that the perforations may be numerous Lenormant draws attention to the wide area of dura which may become invaded by fungous granulations, and makes the interesting suggestion that the disease may extend in some cases, not through the bone, but by means of the sheet of fungous matter situated between dura and bone He is of opinion that these fungous formations reinoculate the bone on its deep aspect, and determine the formation, at a distance from the primary focus, of fresh points of necrosis, which in turn may lead to independent perforations I gather that Lenormant suggests this as an alternative mode of invasion, and does not deny the spread of the disease in many cases if not the majority, through the diploe *Case* 1, our most important in this respect, emphatically supports the latter view What Lenormant describes as taking place between dura and bone occurred in this case between inner and outer tables The description of the conditions found at the time of operation will well bear perusal, being more instructive than any theoretical discussion It will be seen that in *Cases* 1 and 3, at no point did the area affected by pachymeningitis spread far beyond the limits of the suprajacent bone disease, as in cases reported by other observers On the other hand, we found in *Case* 1 a mass of fungous tissue occupying a large oval orifice in the centre of the forehead, forming here an extradural tuberculoma, and this seems to be an unusual feature

The invasion of the frontal sinus in our first case is a unique complication Panse once found the neighbouring cavities of the nasal fossæ filled with tuberculous masses, and noted caries of the roof of each orbit This is the only observation of the kind of which I have been able to find an account In our patient, however, there is nothing really remarkable in the circumstance if we recollect, on the one hand, that the frontal sinuses are developed between the two tables, and on the other, that the neighbouring diploe was invaded by disease

It may be asked in what relation tuberculosis of the skull stands to tuberculous meningitis Fortunately, in spite of the changes which the outer surface of the dura undergoes—or perhaps because of these changes—this membrane opposes an efficient barrier to the penetration of the disease, so that tuberculous meningitis is unusual as a complication Delamare and Conor (quoted by Lenormant) noted it once in 15 cases, and in Pelletier s statistics there were only 9 cases of tuberculous meningitis and 4 of cerebral tuberculosis

Symptoms and Diagnosis—We now approach these somewhat thankless subjects, which are best dealt with together The fact is that there is singularly little to be said on this point that is really pertinent, for in practice it has been found that the disease has but one symptom of any practical value, the cold abscess, and that the diagnosis, like the symptom, loses much of its worth from the fact of its coming too late We are dealing with an insidious affection which can make astonishing progress without giving obvious signs of its presence, and which is consequently all the more dangerous When a cold abscess forms in the frontal or parietal regions, we can of course no longer be in doubt as to the state of affairs, but this phenomenon, which was referred to above is a symptom, is better described as a complication, and, what is more, it is frequently a late complication This is even more true of the tuberculous ulcer or fistula A real symptom

would be headache, but this is often absent, and when present it is of equivocal value since it is perhaps more frequently indicative of cranial syphilis than of tuberculosis Indeed, in adults, syphilis is the more frequent of the two diseases, and we should be quite justified in first thinking of this complaint when a patient with even vague specific antecedents complains of violent and persistent headache Under the circumstances there is no motive for surprise that the diagnosis became clear in Case 1 only after the abscess had formed This patient had recently undergone a course of antisyphilitic treatment and his occipital pain was both violent and tenacious The fever was of practically no value as a symptom, being accounted for by the pulmonary phthisis, indeed cranial tuberculosis of itself probably causes no rise of temperature unless a mixed infection has set in, and when it exists it can usually be ascribed to some pulmonary or other affection It may be argued that the state of the lungs in Case 1 should have turned our thoughts in the right direction, but tuberculosis and syphilis often coexist in the same patient and here the evidence in favour of syphilis was too strong In the absence of a syphilitic history a provisional diagnosis of tuberculosis of the skull might have been made

In *Case* 2 the patient, a child of 18 months, was brought to us for a swelling over the forehead, and the appearance of this, combined with a traumatic history made us think at the moment of a subperiosteal hæmatoma, but the presence of a fistulous opening above the eyelid, and the use of a hollow needle, soon put us on the right track *Cases* 3 and 4 were patients riddled with external tuberculosis, so that no diagnosis but the obvious one was admissible

It is worthy of notice that in *Case* 1, in which the otherwise unfaithful symptom of headache was such a marked feature, incision of the cold abscess was immediately followed by a cessation of the pain As the operation subsequently showed the abscess must have communicated with the subdural space by means of the perforations in the bone so we can assume that it exercised a certain amount of compression on the brain and that the relief of this was responsible for the cessation of the headache There are a few cases on record in which the subcutaneous abscess was observed to pulsate and in another it was possible to reduce the contents of the abscess into the subdural space showing that this communication is not merely a theoretical possibility Besides symptoms of meningeal irritation or cerebral compression in tuberculosis of the skull are not quite unknown, cases having been recorded in which vomiting, convulsions, hemiplegia, and epileptic attacks were observed But they are rare

It has been asked what evidence there is to show that the cases operated on as tuberculous are not really syphilitic The reply is that the problem does not exist for anyone who has had the opportunity of examining the parts at the time of operation In the syphilitic skull the bone is 'worm eaten', the periosteum is irregularly thickened, and the sequestra are dense In the tuberculous skull, on the other hand, we find the bone perfectly smooth right up to the margin of the diseased part, the sequestra, when they exist, are very friable, but more frequently they are represented by perforations containing, at the most, disintegrated bony particles, finally, the periosteum is not appreciably thickened, and at the worst its deep surface is lined with fungous granulations where it lies over diseased bone Except at the point where a cold abscess may have formed, the periosteum may be said to be normal right up to the immediate neighbourhood of the diseased part

Treatment—The local treatment is operative, and only operative On the other hand, unless the surgeon is prepared to resect considerable portions of the cranial vault he had better leave the case alone, for until the parts are exposed there is no means of gauging the extent of the disease Timorous, makeshift operations can only lead to disappointing results where radical measures are needed It is not to be denied that repeated interventions are sometimes necessary, but there is surely something wrong when, as in one published case, no less than thirty-five operations were performed in the course of seven years

Prognosis—In these cases this will primarily depend on two circumstances the co-existence of other tuberculous lesions—more particularly pulmonary—and the progress

made by the cranial disease by the time the patient comes up for operation   It is obvious that the chances of carrying out a radical cure are much more favourable when the disease is circumscribed than when it is diffuse, nevertheless, the invasion of vast areas of skull does not contra-indicate an operation, provided the general state of health is satisfactory   A study of the account of the operations performed in *Case* 1 will show that it is not invariably *necessary to resect entire areas of bone*, and that, even when our interference extends over a large surface area, considerable portions or bridges of healthy bone are left behind   The gaps which remain between have a surprising tendency to fill up spontaneously

In any case our prognosis will have to be somewhat reserved   Koenig's series of cases (published by Clemens) is particularly instructive from the fact that it emphasizes the important part played by accessory tuberculous lesions   Out of 16 cases, 12 had accessory lesions, and of these only 2 were alive at the end of ten years   Of the 4 which are described as free from extracranial localizations, 2 subsequently succumbed and 2 remained definitely cured   Delamare and Conor operated on 11 cases with 8 successes In Pelletier's series of 76 cases treated by operation there are 52 complete cures, 16 deaths, and 8 incomplete cures

ILLUSTRATIVE CASES

Case 1 —G B , age 30, had complained for some time of headache of increasing violence which became so severe by July 18, 1919, that he had to take to his bed   The headache assumed two different forms   in the frontal region slight lancinating pains, and in the occipital a dull and yet very pronounced tenacious pain   A short time before he had undergone a course of antisyphilitic treatment, though the history of this disease is somewhat obscure   Wassermann negative R used evening temperature   Profuse night sweats   Both lungs the seat of tuberculosis

On Aug 1, a collection of pus over the right frontal region was evacuated by a small incision over the eyebrow, after which the occipital pain promptly vanished   The pus had a distinctly tuberculous aspect   The wound healed in three weeks   Further collections were opened by another medical man over the right eyelid and right side of forehead respectively on Sept 1 and Sept 16   After the latter, a depression was felt on the surface of the bone at a point corresponding to the site of the incision   Throughout August and September the evening temperature was in the neighbourhood of 102° to 103 6°, and the night sweats continued to be profuse

OPERATION 1 —Oct 6   A large horseshoe shaped flap was turned down on the right side of the forehead, continuing all the tissues down to the bone, exposing purulent granulations and three small perforations of the bone lying close up to the coronoid suture, the highest being about 2 in from the lowest   A probe introduced in turn into each of these led down to the inner table, and, the necessary inclination being given to the probe it was seen that these perforations communicated one with the other by means of a tunnel passing between inner and outer tables   Using alternately a Dalgren and chisel we removed the outer table between the perforations so is to form a canal over 2 in long and ¾ in wide, the bottom of which was composed of inner table   By probing the edges of this canal a further fistula was found leading towards the middle line, where it ended in a larger perforation ⅓ in in diameter, which was exposed by further incision of the soft parts   This fistula or tunnel we also transformed into an open canal   This last perforation was found to lead down to the dura, which was thickened and rough, and did not pulsate   It was thoroughly scraped, but very little came away   A fifth perforation was finally exposed a short distance above the right eyebrow   It was nearly 1 in in diameter, and corresponded with the depression felt after incision of the third abscess   It contained fungous masses and a few bony particles, and its base was formed by thickened dura   It could not be shown to communicate in any way with the other perforations Turning our attention to the flap, we found that the deep surface of the periosteum was covered with fungous granulations, but only opposite the perforations, and that these came away quite easily, leaving behind an apparently healthy membrane   The whole wound was now thoroughly curetted and soaked twice with iodine, after which it was sutured up completely   *The perforation above the eyebrow was drained through the original small incision made for opening the last formed abscess*

Through the fistulous opening in the outer corner of the eyelid, left after incision of the second abscess, it was possible to feel rough bone with the probe   but the treatment of this we judged it advisable to postpone   Our horseshoe incision healed by first intention

OPERATION 2 —Nov 17   Transverse incision over outer part of eyebrow down to the bone, by which we exposed a small perforation   A stylet introduced into this led towards the middle line of forehead with an inclination upwards, the fistula running between the two tables and above the frontal sinus   As in the first operation, this tunnel was transformed into a broad canal by removal of the outer table, and this led us almost to the middle line where our canal culminated in an oval perforation 1½ in by 1 in with its long axis placed vertically   It contained a fairly

compact, bulging mass of fungous granulations, on removal of which with scissors and sharp spoon the pulsating dura mater was exposed. The bony margin of this orifice, is in the other perforations, was friable over a very short distance. We removed it with Luer's forceps, thereby considerably adding to the loss of substance. At the lower margin of the orifice the exploring probe slipped easily into a large cavity having bony walls. This proved to be either the right frontal sinus alone, extending well over the middle line, or perhaps the two cavities turned into one by necrosis and disappearance of the dividing wall. It was found to contain fungous granulations which we removed with a sharp spoon after enlarging the opening from above. The whole cavity was thoroughly curetted and painted with iodine, after which the wound was sewn up completely. Sutures were removed on the seventh day.

When the patient left hospital one month after operation his weight had increased astonishingly, sleep and appetite were perfect, night sweats had considerably diminished. The frontal region was quite painless on pressure, but unevenness of the bone could be felt, as well as a pulsating depression in the middle line. Six months later he wrote that his general health was perfect, and that he observed a marked improvement in his mental faculties. He added that there was a point along the line of the horizontal scar at which a drop of pus appeared from time to time, and that he would come back to have this treated when he should have nothing better to do. The gap in the centre of the forehead had nearly filled up and no longer pulsated.

Case 2.—A girl of 18 months with a swelling on forehead and traumatic history dating ten weeks back. Sleep and appetite said to be disturbed, but the child looked healthy enough. The swelling occupied the centre of the frontal region, was about 1½ in. in diameter and reached to root of nose. The skin covering the central part was of a reddish violet colour, the contents were fluctuating, and at the periphery a raised border could be felt all round, giving like the sub-pericranial hæmatomata of children, the impression of a depressed fracture. A small fistulous opening had appeared a fortnight earlier, immediately below the left eyebrow. With a syringe we withdrew obviously tuberculous pus from the swelling, and after this the impression of a bony depression became stronger.

OPERATION, Oct. 29, 1919.—Horseshoe incision down to bone, by which a flap was marked out which in extent covered that of the swelling. Bone apparently normal, but the periosteum turned down with the flap was lined with fungous granulations, which round the edges were more voluminous, more consistent and more adherent, thus accounting for the false impression first produced. These granulations were scraped away. In the left lower corner of the wound we found a fistulous track leading to a point on the supra orbital arch where the bone was roughened. This was well scraped and the whole wound was treated with iodine. Suture of the whole wound, which healed by first intention. The fistulous opening beneath the eyebrow was closed at the end of a fortnight.

Case 3.—Zolti Joseph, age 8, a gipsy, the subject of multiple tuberculoses of the extremities, presented in addition (1) In right temporal region two circular ulcers the size of sixpenny pieces connected by a small bridge of skin, both having undermined edges and thin bases formed by bone covered with fungous granulations. (2) A fistulous opening at the outer angle of left eye, the orbital process of the malar bone felt uneven, and the neighbouring part of the temporal fossa was slightly swollen.

OPERATION 1, May 26, 1920.—The ulcers of the right temporal region were transformed into a single wound by division of the intervening substance, their edges were cut away, and their bases thoroughly scraped. It was now seen that the corresponding part of the temporal muscle had quite disappeared, and that the bone was exposed over a larger area than we suspected. Incision of the lower margin of the wound exposed the remains of the temporal muscle, which was pale and infiltrated. On detaching it and advancing towards the angle between the zygoma and outer margin of the orbit, we came upon a perforation of the bone the size of a sixpenny piece lying over the suture between the squamous part of the temporal and the great wing of the sphenoid. The base of the perforation was formed by dura mater of normal appearance. The perforation was circular, and its lower edge formed by the whole thickness of the skull, which was here quite smooth. On the other hand, the bony margin forming the upper two thirds of the circumference of the perforation was very thin, and a considerable circular area of bone surface beyond was rough in consequence of the total disappearance of the outer table. The area of inner table thus exposed was bounded above behind and in front by a bony ridge formed by the edge of the outer table, and extended over the squamous and sphenoidal regions as a segment of a circle. This also marked the limit of the disease, for the outer table beyond was perfectly healthy. After snipping away the edges of the perforation and curetting the rough bone surface, the whole was painted with iodine.

To sum up, the following were the bone lesions found —

1. A perforation of the whole thickness of the bone with exposure of the dura mater
2. A rough exposed surface of inner table extending above, behind, and in front of the perforation, and limited by
3. The edges of healthy outer table, which formed a large segment of a circle lying about one inch from the perforation above, while the horns of the segment ran into, and lost themselves in, the lower margin of the perforation

Operation 2, June 3 —Kronlein s incision on the left side exposed the carious outer margin of the orbit   The orbital periosteum was detached, the external angular process of the frontal bone and frontosphenoidal process of the malar were divided with the chisel, and the diseased part of the outer wall of the orbit was removed with Luer's forceps, thereby putting into communication the orbital and temporal fossae   The soft parts, including the orbital periosteum, looked healthy Operation completed by suture of flap and drainage of fistulous opening after resection of its edges

One month later, when the child left hospital as incurable, the right temporal wound had become again filled with fungous granulations, on the left side the wound resulting from Kronlein's incision had closed by first intention, but the fistula still secreted and a cold abscess was in process of formation over the zygomatic arch   The extracranial lesions had also progressed

Although the cranial affection was not treated by operation in our fourth and last case, for reasons which will become evident, the local appearance of the disease was such as to support much of what we have said regarding its pathology, without invalidating any of the opinions expressed   The case is illustrative of the vast areas which may be attacked, and supports the theory that the disease tends to spread in the diploe   We have the best reasons for believing the sequestra to have been formed exclusively at the expense of the outer table, though of course, without exposing the parts by means of an operation, it was impossible to judge accurately of the condition of the inner table   All that can be said is that no perforations, and indeed no obvious disease of the inner table, were appreciable

Case 4 —A T , age 38, the mother of two fine girls, had suffered for twelve years from external tuberculosis affecting especially the lower extremities   The wounds had opened and closed repeatedly during this period   When she was seen in February, 1920, the greater part of the left arm and forearm was turned into a vast suppurating wound   An a ray examination showed the shaft of the humerus to be widely diseased   In view of the great pain suffered by the patient and the impossibility of the arm ever becoming of any use, we advised amputation   As the patient was at the same time the subject of advanced pulmonary tuberculosis, we removed the arm at the shoulder joint under local anæsthesia (April, 1920)   A large part of the wound healed by first intention, but the lower portion assumed a distinctly tuberculous aspect, and the process subsequently extended to a considerable area of chest wall below the shoulder, though it finally healed   In August the patient complained of a painful swelling on the left side of the head and this soon ulcerated allowing uneven bone to be felt in the neighbourhood of the antero inferior angle of the parietal   In the following months small pieces of bone came away, and in February, 1921, the local condition was as follows —

A lozenge shaped ulceration, 4 in by 2½ in , spread over the left side of the head, beginning at a point behind the level of the ear, but higher up in the parietal region, and extending forwards well into the frontal region   Pressure on the thin, undermined edges was painful, and caused pus to ooze out   The base of the ulcer was formed of smooth red granulations lying on denuded bone, and its surface was rendered irregular by the presence of two cup like depressions, of which the larger measured 1½ in in diameter   Examination showed these depressions to be due to a loss of substance affecting the superficial layer of bone alone, for a bony basis was everywhere to be felt with the probe

Separated from the anterior extremity of the ulcer by half an inch of skin was a second ulceration the size of a sixpenny piece, in which rough bone capped with dried up secretion was visible The skin of the upper eyelid was also ulcerated, and there was purulent conjunctivitis

Finally, there was in the centre of the forehead a circular ulcer over 1 in in diameter, from which we removed with forceps a flat, honeycombed sequestrum over 1 in long and rather less in breadth, exposing a second layer of uneven bone beneath (inner table)

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A FURTHER CONTRIBUTION TO THE STUDY OF CYSTS AND PAPILLOMATA OF THE BREAST.

By Sir GEORGE LENTHAL CHEATLE, LONDON,

In two former contributions to this journal I have endeavoured to demonstrate certain pathological changes in the breast epithelium and their relation to 'cystic changes.' In

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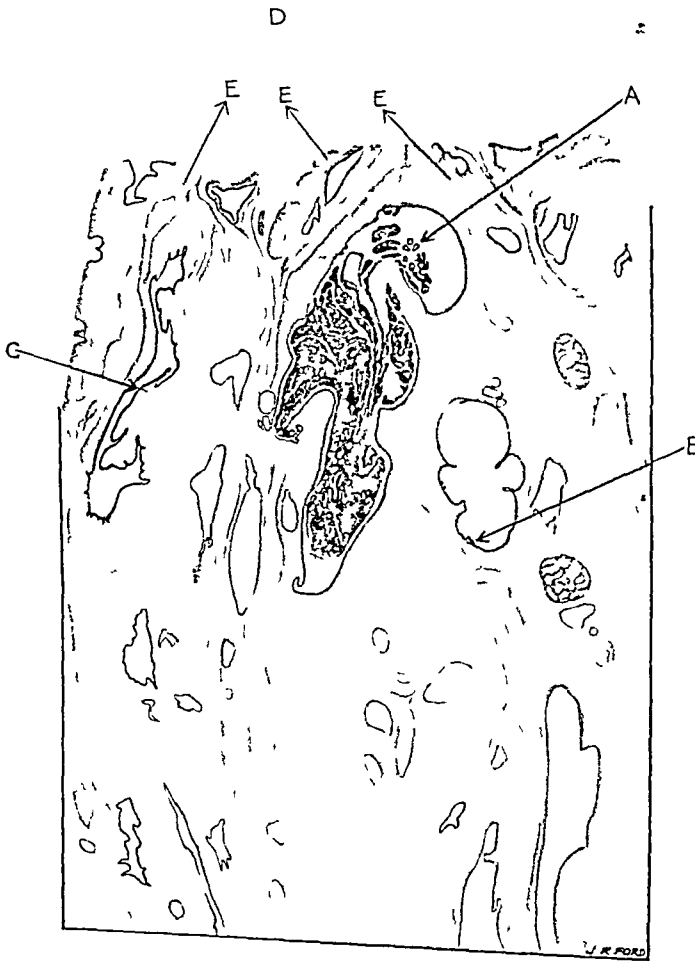
FIG 213.—Shows a multiradicular papilloma in the ampulla of a duct (A)   B is part of another ampulla in which the indicator is pointing to a part of which Fig 214 is a higher magnification   C is a normal ampulla   D is the position of the nipple, and E E E mark the direction of the ducts towards it   It will be noted that there is no collection of chronic inflammatory cells around the tumour containing ampulle

the present paper I hope to make further observations which may serve to indicate the connection between cystic and epithelial changes on the one hand, and the development of new growths of a simple or malignant type on the other
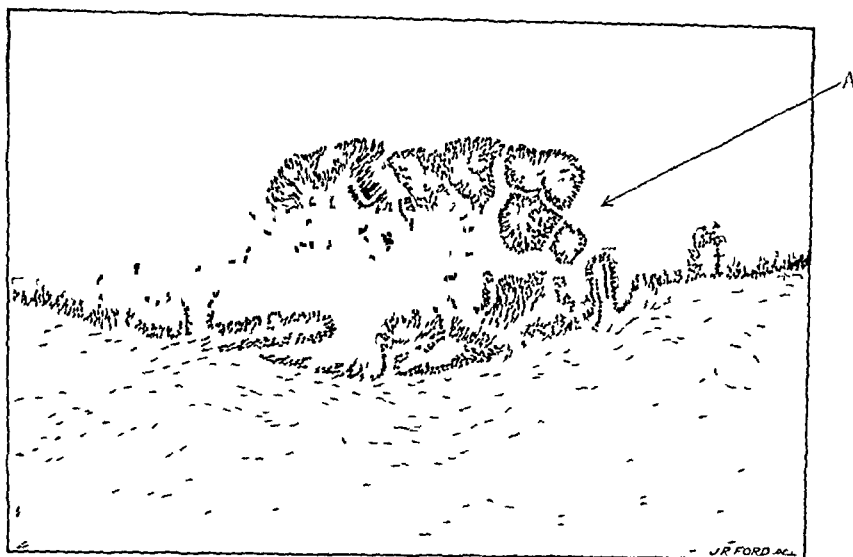
Fig. 214.—Is a high magnification of the ampulla B in Fig 213 It will be noted that there is no collection of chronic inflammatory cell out ide this ampulla which contains a multiradicular papilloma (A) in an early stage of growth

Fig. 212.—A portion of a whole section of a breast —it shows two parts of an ampulla (B) which is filled with a papilloma At C deeper in the ampulla which also contained a papilloma It is not shown in this section A L the B There are no chronic inflammatory cells outside the ampulla B
The gland was kindly sent to me for examination by Mr Simpson Handley

PART I

First, I wish to draw attention to two forms of papilloma in ducts One is of greater importance, since it is often difficult to determine whether it is benign or malignant

A —There is the papilloma with a single fibrous stalk of attachment, on the kind suggestion of Sir Humphry Rolleston I venture to name this form the uniradicular papilloma The axis of fibrous tissue is usually coarse and comparatively thick and the unattached extremity may divide into two or more branches It does not grow large, and rarely exists in a breast as a single tumour This rare condition is seen in THE BRITISH JOURNAL OF SURGERY viii, No 31, Fig 207 Usually its presence is associated with papillomata of the next type , then it is frequently multiple

B —For reasons to which I have alluded, the second form of papilloma is the more important In this there are many stalks of attachment to the duct in which it occurs On the same kind advice I name this a multiradicular papilloma The axis of fibrous tissue is most delicate and fibrillous, and its branches are so numerous that they fuse and thus form a network within the duct, which in consequence is much distended (see Figs 213, 214, 215 and 216) Accompanying the papillomatous formation there is to be seen often a marked hyperplasia of the epithelium attached in a sessile manner, in which there is no axis of

fibrous tissue   This papilloma sometimes may occur alone, or more frequently it may be associated with others   In some breasts it may be mixed with the papillomata of the uniradicular form   If strict limitation of the tumour to the duct walls is a sure guide, the tumours in *Figs* 213, 214, and 215 are benign   The tumour in *Fig* 216 is malignant , on careful microscopical investigation the duct walls are seen to have been invaded

There is no inflammation surrounding the ducts which contain the papillomata in *Figs* 213, 214, and 215   There was intense inflammation surrounding the duct containing the papilloma in *Fig* 216   The ampulla was undergoing acute suppuration   Pus and blood were being discharged from the nipple when Mr Corner removed the gland
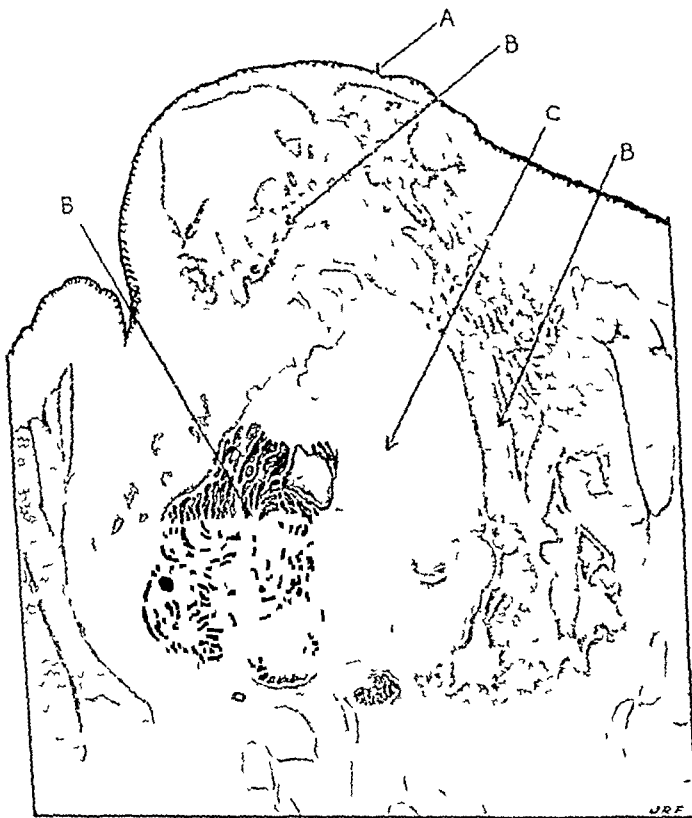
Fig 216   Shows a large malignant multiradicular papilloma (B) in a much distended ampulla   The tumour was acutely infected and was suppurating, in most of its parts   C is a large hæmorrhage   The surrounding connective tissue was in a marked state of acute inflammation   and at parts the tumour was invading the walls of the duct   A marks the nipple   The gland was kindly sent to me for examination by Mr J Corner

There is another feature characteristic of the multiradicular type of papilloma besides its close relationship to malignant disease   It is that often it can be demonstrated as originating in the ampullæ of ducts (*see Figs* 213, 214 215, 216)   In the breast from which *Fig* 217 is drawn, there are two ampullæ, each of which contains cancer undergoing colloid change   There is too much of this degeneration to enable me to decipher which of the two types of duct cancer the ampullæ contain   The rest of the tumour is mainly licriform   in type   The point I want to emphasize is that the ampullæ of ducts have great pathological importance   It certainly appears to me that their contents would be more stagnant than those in other parts of the dilated ducts, and that if these contents contained an irritant the action would remain undisturbed for long periods   Although I consider, for many reasons, that agents of irritation can and do enter the breast through the open ducts at the nipple, yet I am aware of the possibility of stagnant, or altered and

stagnant secretion also acting as an irritant   As I have said many things point to the
entrance of irritants through the duct orifices   among them is the article by Mr C J Bond
in the *British Medical Journal* March 29 1913, on " The Mucous Channels and the Blood-
stream as Alternative Routes of Infection

In two previous communications (BRITISH JOURNAL OF SURGERY, 1920, VIII, Nos 30
and 31) I described two types of duct cancer which may remain pure, and indicated that
both types might be found in one tumour   These types were the papillomatous and
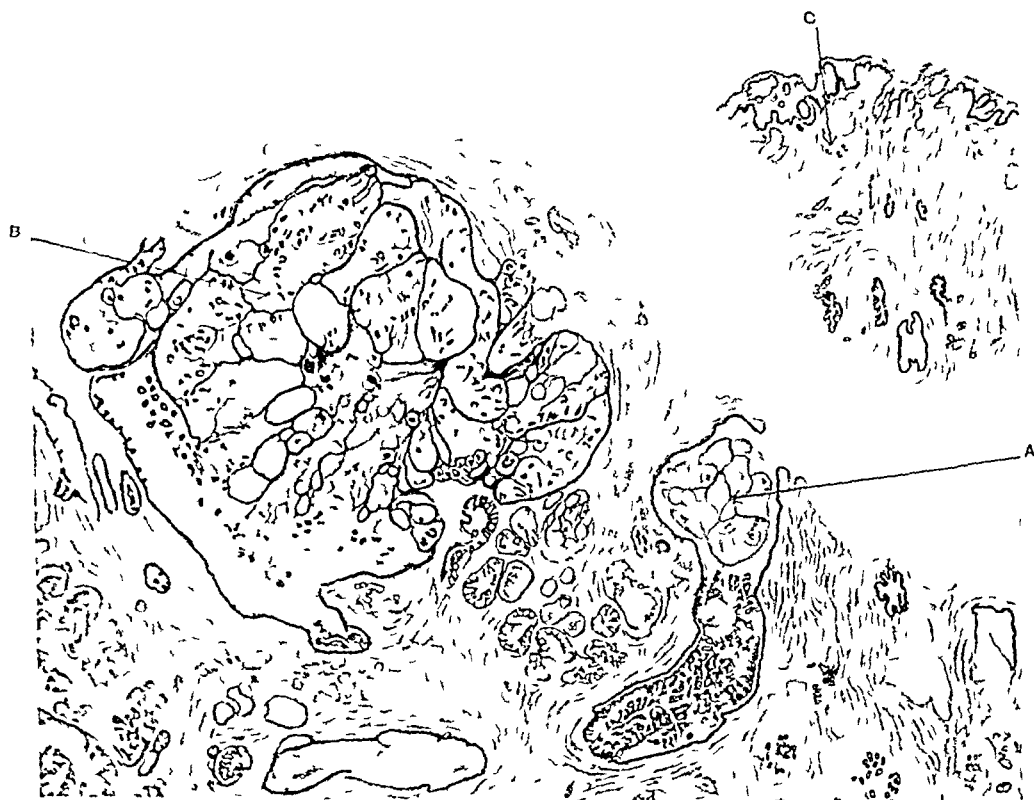
Fig 17   A part of a whole section of a breast   It shows two ampullæ (A and B) which contain separate foci of
primary cancer under one colloid degeneration   The cancer in the ampulla B has invaded the walls of the duct and
irregularly the other   serial section   showed there was no continuity between the cancer in A and the cancer in B   C)
the nipple

the laciform   Of the two the papillomatous was the less malignant, but the 'laci-
form   and mixed duct cancers were capable of being the most malignant seen in breast
cancer   Dr Archibald Leitch in a short illuminating article (*Archives of the Middlesex
Hospital* 1905 p 80   On Secondary Malignant Conversion of Epithelium'), pictures
the laciform condition in a duct and definitely shows that a comparatively extensive
surface of epithelium has taken part in the primary cancer process   Dr Leitch's article
should be read by all who take an interest in cancer   Before publishing my two papers
in this journal I was unaware of Dr Leitch's original observations   otherwise I would
have drawn attention to them

PART II

The condition of breast epithelium to which I pass on to refer, is clarified by the examination of whole sections cut from three breasts   The breasts were removed from
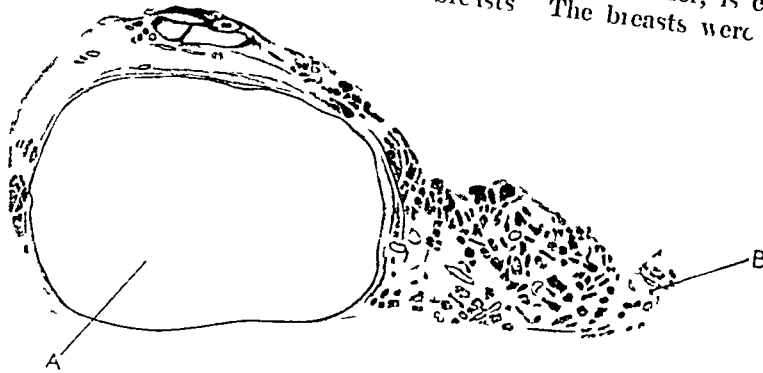
FIG 218 —A whole section of half a breast which was removed on account of the large microscopic duct (A) it contained   B points to that part of the breast from which the duct A in Fig 219 is drawn   Many smaller duct cysts can be seen in the drawing

three different individuals   The condition was characterized by a diffuse, benign desquamating hyperplasia of epithelium in ducts and acini around which there was no sign of chronic inflammatory changes   I am convinced the condition to which I refer is primary
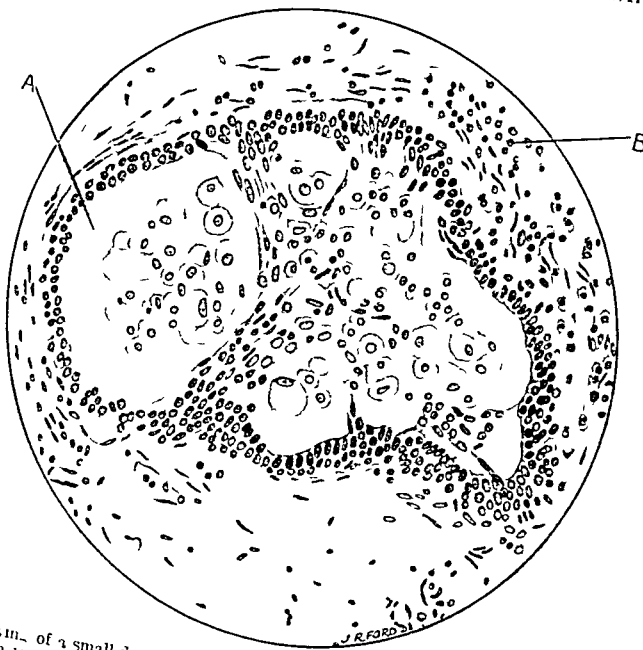
FIG 219 —A drawing of a small duct (A) from B in Fig 218   The epithelium can be seen undergoing desquamative hyperplasia at five or six different points   The cells undergoing hyperplasia soon become long, intra-luminal and desquamated after becoming large round degenerated cells   These desquamated cells fill and distend the duct   The contents appear clinically as white thick fluid   The fibrous tissue outside the duct at B show slight local proliferation   There are no leucocytes at this or any other part   The proliferation at B is secondary to distention of the duct

within the gland , it may be due to an irritant, but it is not secondary to chronic inflammatory changes outside the epithelial structure   I regard the chronic inflammatory

changes which so often are associated with it as secondary localized and infrequent and small foci of chronic inflammation

Fig. — A drawing of a large duct (A) from another breast in which the duct has become distended is the result of desquamative hyperplasia of the epithelial lining. There are no leucocytes outside this duct, nor were there any leucocytes out side any of the ducts in this breast, although it was locally affected by epithelial hyperplasia

is often least marked where the inflammation is greatest

Clinically, the condition in some breasts is marked by their containing cysts or only one palpable cyst. I shall point out later that I am convinced these cysts are determined by the distension caused by the diffuse hyperplasia of the glandular epithelium. In other breasts the condition is masked by small nodules universally distributed over the whole glands. In yet others only a segment of a breast may be thus affected, indicating perhaps that a duct and its distribution is the main part that is undergoing the change. The nodules are mainly the dilated ducts. The distention of the ducts is the cause of the pain.

Microscopically, the condition is seen to be a hyperplasia of large tracts of ducts and some of the acini into which their terminal branches lead.

I cannot conceive that such however intense it may be can be the cause of so diffuse a hyperplastic change

There are many reasons for thinking as I do, among them are the following. In many parts where there is no hyperplasia of epithelium, chronic inflammation is most marked (*Fig* 222) In the three breasts to which I am now in a position to refer, there is no chronic inflammation to be seen anywhere in the course of the ducts and acini which contain the hyperplasia of epithelium. And in other breasts where the epithelium is undergoing this desquamative hyperplasia in a duct that is locally more or less surrounded by chronic inflammation, the hyperplasia I need not labour the point

Fig. — A drawing from a terminal duct and it branches. The duct and some of the acini into which it lead are seen to be undergoing desquamative hyperplasia. There are no leucocytes outside or in the gland cysts of this and the preceding breast. There are no leucocytes present in any part of whole section taken from the breast

The hyperplasia of epithelium can be seen

in its earliest stage in a transverse section of a small duct in *Fig* 219, which is taken from part of the cystic breast, *Fig* 218, B   The epithelial cells at five or six different places have proliferated and become longitudinal in shape   Early desquamation is obvious   The large round desquamated cells are typical contents of ducts   I have not seen them in acini   There are no lymphocytes in the tissues outside this duct at B   There are a few connective-tissue cells that have proliferated   It is impossible to conceive that a dilating distended duct, as this is, could undergo these changes from the normal size without inducing some action on the part of the surrounding tissue   The changes in the surrounding tissue are, I believe, secondary to the duct changes   Similar intra-glandular changes can be seen in *Figs* 220 and 221   *Fig* 220 is a duct that is reaching the cyst stage   *Fig* 221 is the termination of a duct in the same process, but not so advanced , some acini into which it leads have escaped sharing in the process   There is no sign of chronic inflammatory changes outside the ducts and acini of this breast, from which *Figs* 220 and 221 have been drawn   Although an irritant stagnated within the duct is probably the cause of the epithelial hyperplasia, to term the condition 'chronic mastitis' or 'parenchymatous mastitis' is in my opinion, erroneous   I would
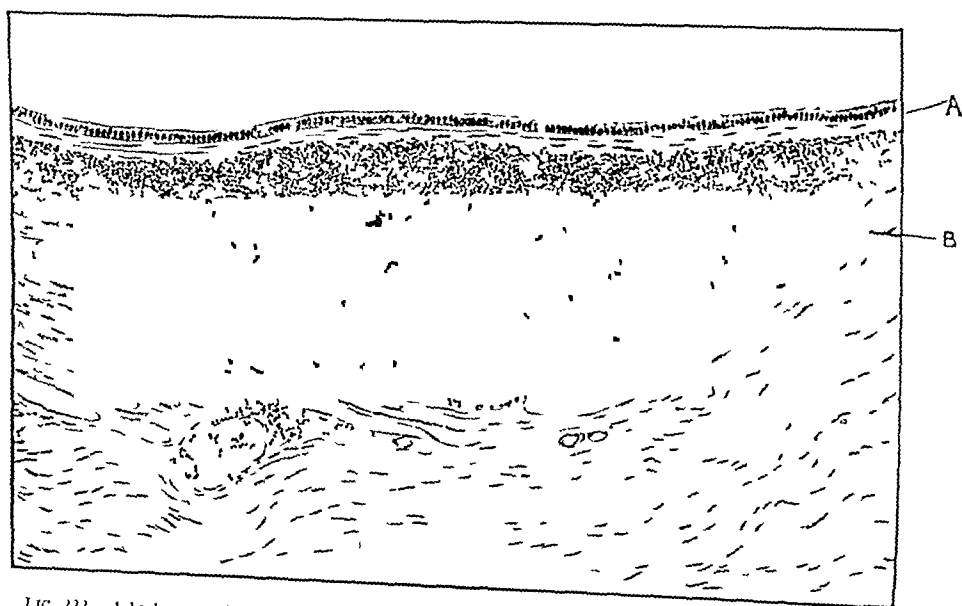
FIG 222 — A high power drawing of one margin of a longitudinal section of a duct   The epithelium (A) is normal   The tissues outside the duct contain a collection of lymphocytes (B), among which are some polynuclear leucocyte

prefer to call it a diffuse benign desquamative hyperplasia of breast epithelium   I regard it as a cause of cyst formation   Papillomata are absent in the three cases under observa-tion   these may complicate the condition, but they are not an essential part of it

This diffuse desquamative hyperplasia is seen frequently in the epithelium of fibro-adenomata of breasts   It is also to be observed in many breasts where cancer is present   I look upon the condition as pathological

In future it is probable that the course of events may be stated in the following way   When cysts are once formed they may predispose to further pathological changes which otherwise would not have occurred   The cystic stage may lead to distention and stagna-tion, which would favour the continued undisturbed action of an irritant   This in turn might serve as the direct prelude to further changes, probably resulting in what is commonly regarded as a simple or malignant tumour   Our present ignorance of the cause and limitation of epithelial hyperplasia prevents the immediate and complete acceptance of this fascinating theory   On the evidence before me, all I can say is that I do not believe that the tumours described here would have arisen if the cystic state had not in some way acted as a predisposing and determining cause of their initiation and growth

RECONSTRUCTION OF ANKYLOSED KNEE-JOINTS

By Sir W. I. de COURCY WHEELER, Dublin

OPINIONS are divided as to the relative merits of arthroplasty and excision in the treatment of many stiff and diseased joints. In certain cases the indications for one or the other are comparatively clear. The pendulum has swung rather back towards excision in the case of the elbow-joint; both operations yield satisfactory results in the case of the shoulder, but, in ankylosis of the hip, stability is so essential that, if a mobilizing operation is indicated (a rare contingency), most surgeons will prefer arthroplasty to excision.

There is almost unanimity of opinion concerning the knee, namely, that sound ankylosis in the great majority of advanced cases is the only desideratum. Reconstruction of an ankylosed or diseased knee-joint with a view to the restoration of movement has been summarily dismissed by many authorities as an operation based on unsound principles and rarely followed by success. The following case
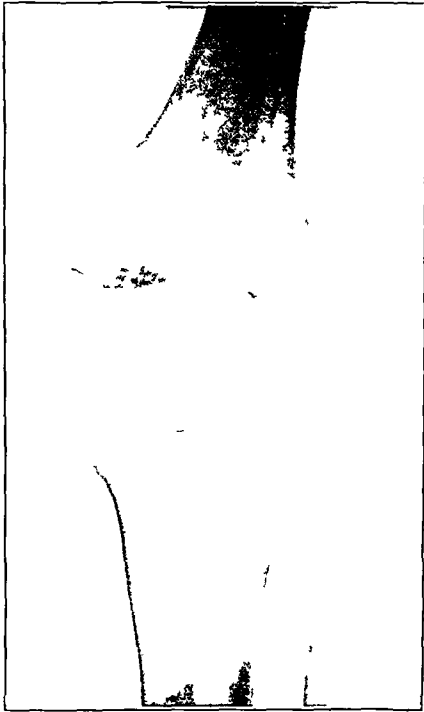
FIG. 223.—Right knee-joint ankylosed in extension

FIG. 224.—Left knee-joint ankylosed in flexion

is reported to illustrate that this condemnation, although justifiable in a general way, has been too emphatic and that in certain cases success may be anticipated —

In August, 1919, a little girl, age 11, gave a history of acute osteomyelitis of both tibiæ, a prolonged illness, and frequent operations. Numerous scars, the result of healed sinuses and operation wounds were in evidence down the front of both shins. Both knee-joints were firmly ankylosed. The left knee was ankylosed in flexion, the right in extension. X-ray photographs showed firm bony ankylosis, with destruction of the epiphyses of the femur and tibia on both sides (Figs. 223 and 224).

The parents were told that the general opinion of surgeons was against operation that lateral stability could not be ensured, and that in the absence of crucial ligaments it was difficult to prevent the tibia rocking backwards and forwards on the femur   Lateral mobility, and forward and backward play of the tibia on the femur, with a want of check on inward rotation of the tibia, might render the knees so insecure that walking without aid might be quite impossible   These were the orthodox arguments against operation   On the other hand, it was pointed out that much could be done in the remodelling of the bones at operation to promote security for weight-bearing and that the formation of a capsule and ligaments might be expected in time, such as is seen surrounding a false joint the result of an old ununited fracture of the long bones

In September, 1919, an operation was performed on the left (flexed) knee after the manner recommended by the late J B Murphy   An incision was made about 4 in long on either side of the patella, slightly curved with concavity backwards   The skin was reflected freely, and two tongue-shaped flaps of fat and fibrous layer of the capsule were fashioned, the base of each flap being downwards, attached over the internal and external

Fig 225 —Both knee joints in extension after operation

surfaces of the upper extremity of the tibia   A Jones gouge was easily driven through the new bone binding the femur and tibia and the knee was fully flexed   The lower end of the femur and the upper end of the tibia were cleared of all irregular bone and both surfaces fashioned to leave as large an amount of bone in a lateral diameter as possible and thus diminish the tendency to lateral instability   A mortise in the form of a sub-stantial groove (not well shown in the skiagrams) was made from front to back on the surface of the femur, and a corresponding tenon cut in the tibia to limit the lateral gliding of the one bone upon the other   Care was taken to remove slightly more bone from behind in order to diminish any tendency to hyper-extension   The flaps were now placed loosely across the upper end of the tibia and fixed by a few points of suture in position

The extensor apparatus was unduly lax when the flexed joint was brought into the
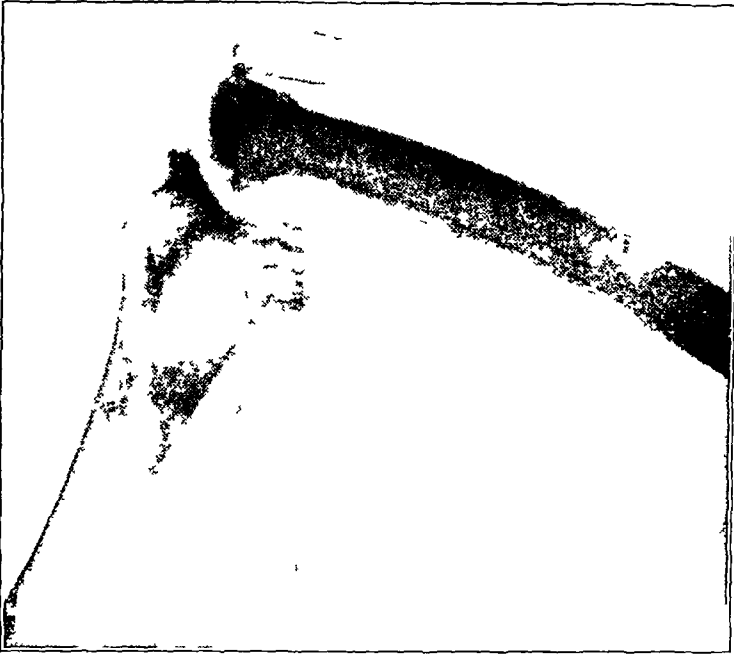
FIG 226 —Showing amount of voluntary flexion in left knee joint 2 years after operation
Note the patella turned turtle .

FIG . —Showing amount of voluntary flexion in right knee joint 18 month
after operation

straight position, and the patella was 'turned turtle' with great ease—a manœuvre which prevents subsequent fixation to the front of the femur

There was little or no pain after operation, and the stitches were removed after eight days The leg was immobilized on a simple back splint

After removal of the stitches the child was encouraged to move the joint actively as far as possible as it lay unbandaged on the splint There was a striking absence of pain The knee moved actively a few degrees in flexion and extension after the first dressing The child gave this demonstration to every visitor, until, in an astonishingly short time voluntary flexion of the joint to half a right angle was possible Great care was taken to prevent any movement in a lateral direction Massage and passive movements were employed after the first fortnight to hasten the development of the wasted

FIG 8 —Snap shot photograph of left knee child walking

FIG 229 —Snap shot photograph of right knee child walking

quadriceps The child was discharged two months after operation on a calliper splint jointed at the knee She could walk now with easy voluntary flexion of the left knee to about half a right angle and without pain

The absence of pain on either active or passive movements interested me, for to this phenomenon the success of the operation is in a large measure due The child regarded the after treatment from the start as being something in the nature of a game, and worked hard in her efforts to give satisfaction and surprise as we daily watched the return of the joint to something approaching normal

The absence of pain after operation is due probably to the removal of any remains

of the old lateral ligaments and capsule of the joint which carry the sensory nerves *
Murphy states that, in addition to affording a wider range of motion in the new joint
removal of the ligaments together with the capsule also obviates one of the causes of
post-operative pain   I cannot think of anything more important to obtain a good result
in arthroplasty operations than prevention of pain   The early after-treatment is
simplified a hundredfold

Six months after the first operation the patient was re admitted into the private
hospital, and a similar operation undertaken on the second knee   The joint on this
occasion was straight and not flexed, and the operation was rendered more difficult
in consequence   The quadriceps extensor tendon and the patellar ligaments were tense
and the patella could not be turned turtle as in the previous instance   A flap was
fashioned and inserted between it and the femur in addition to the main intra
articular flap

The after-treatment was modified and improved upon   Extension was maintained
by means of a Thomas knee bed-splint which was daily loosened for massage and active
movements   As before there was no pain and the child co operated admirably with
the efforts to promote movement and develop the muscles

Two months later she was discharged, still wearing a jointed calliper splint on the
left leg and a jointed leather moulded splint from groin to ankle on the right

She presented herself for examination two years after the first operation and
eighteen months after the second   She is walking freely without splints or crutches, and
but for a slight forward bend of the body, a habit contracted to obtain better equilibrium,
her gait is to the ordinary observer almost normal (*Figs* 228, 229)

Sir Robert Jones saw the patient in the early stages of treatment when he was
visiting Dublin

She was exhibited at the Royal Academy of Medicine in Ireland, and, when asked
to hop across the room, did so with agility   There is a little lateral mobility, but
not more than is often seen following stretching of the ligaments after prolonged effusion
or extension in the treatment of injuries   In this connection Murphy states   " In the
early days of our arthroplasty work we felt that something serious would happen if we
totally removed the articular ligaments   As time went on however, I learned that large
ligaments developed about the site of a pseudarthrosis '   This statement is probably
correct,   If no movement is allowed in the lateral direction during repair, there will be
a corresponding condensation of the connective tissues on each side   On the other hand,
movements are secured in desired directions from the earliest moment   Connective
tissues trained in this way eventually take on the form and function of ligaments

The object of this communication is not to advocate the operation of arthroplasty
of the knee joint, but to show that under favourable circumstances when there are real
indications for the operation, there is a reasonable prospect of success

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* Ligaments receive nerve fibres both sensory and vasomotor   The nerve fibres always come from the
same nerves that supply the muscles moving the joint and supplying the overlying skin (Rudolph Fick)

RECONSTRUCTION OF THE SHOULDER

By Sir W I de COURCY WHEELER, Dublin

The operative possibilities in cases passing through hospitals for disabled pensioners as time goes on are becoming less and less During the three years since the War the majority of the patients have been operated on once or many times, and a halt has been called in most cases to all but purely non-operative orthopædic methods of treatment There are cases still which are admitted for conditions of non-union malunion, and cross union of bones capable of repair, but they are rare

The same applies to joints, nerves, and muscles, although here, too, some cases appear to have drifted from one place to another without the obvious rational operative treatment having been tried

The following case illustrates the last statement —

A pensioner, aged about 25, was wounded in November, 1918, by a high-explosive shell The right shoulder below the acromion process was carried away *en masse*, skin, muscles, and bone, leaving only a pedicle on the inner side carrying the main vessels and nerves by which the arm hung helplessly to his side The wound was septic and unhealed for eighteen months

On admission, dense cicatrix occupied the right deltoid region The area of the scar extended backwards over the lower scapular region, and forwards over the insertion of the pectoralis major muscle (*Fig* 230) The movements in the hand were strong and free All the muscles of the upper arm were out of action, nevertheless he could flex and extend the elbow with considerable strength This trick was accomplished by fixing the extensors and flexors of the forearm below and contracting them on their attachment to the condyles of the humerus, thus producing flexion and extension of the elbow and an excellent mimicry of the normal action of the biceps and brachialis anticus muscles *Fig* 231 shows a skiagram taken at this time

The patient had been told so often that nothing could be done to restore the shoulder and upper arm that consent to operation was only obtained on condition that it was completed in one stage

The scar was subjected to massage, radiant heat, etc , in the hope of lighting up any latent sepsis, if such existed, before a major operation was attempted

Operation, April, 1920 —

1st Stage —Two incisions were made, one just below the acromion process, extending forwards under the clavicle and backwards beneath the spine of the scapula, above the cicatrix The second skirted the cicatrix below at the level of the middle of the shaft of

Fig 230 —Pensioner K Wounded 1918 The right arm is seen hanging from the trunk by a pedicle containing the vessels and nerves The skin deltoid muscle and upper end of the humerous were blown away

the humerus The incisions met in front and behind so as completely to encircle all the scar tissue The dissection was slow and tedious, as the scar (the result of old sepsis) had penetrated deeply in the position corresponding to the shoulder-joint After removal of the scar, a deep hiatus was left between the acromion process and the upper end of the fractured humerus , the arm hung like the sleeve of a coat from the inner flap containing the vessels and nerves

2nd Stage —The upper end of the humerus was cleared and divided until healthy bone appeared, and all irregularities were removed The glenoid cavity was exposed and an effort was made to freshen the surface

3rd Stage —A bone-graft 9 in long was removed from the inner surface of the right tibia with the Albee twin saw, regulated so as to cut a graft of tight fit for the medullary cavity of the humerus The graft was driven tightly into the humerus for four inches

The arm was abducted and held in position so that the graft lay along the glenoid cavity, the upper extremity touching the acromion and coracoid processes (*Fig 232*) The intention was to obtain a broad union between graft and scapula with the arm in slight abduction

4th Stage —Five inches of the graft lay bare, with no skin, muscle or other soft tissues for a covering To remedy this a plastic operation of some magnitude was necessary A large pedicled skin-flap was fashioned from the front of the chest, and the skin above and below the original incisions freshly undermined A skin covering was obtained, but it was obvious that this was insufficient for the graft although ample so far as the wound area was concerned It was decided to replace the destroyed deltoid muscle by transplantation of the clavicular portion of the pectoralis major outwards as described by Elmslie The attachment of the muscle to the clavicle was separated subperiosteally, and the clavicular portion isolated from
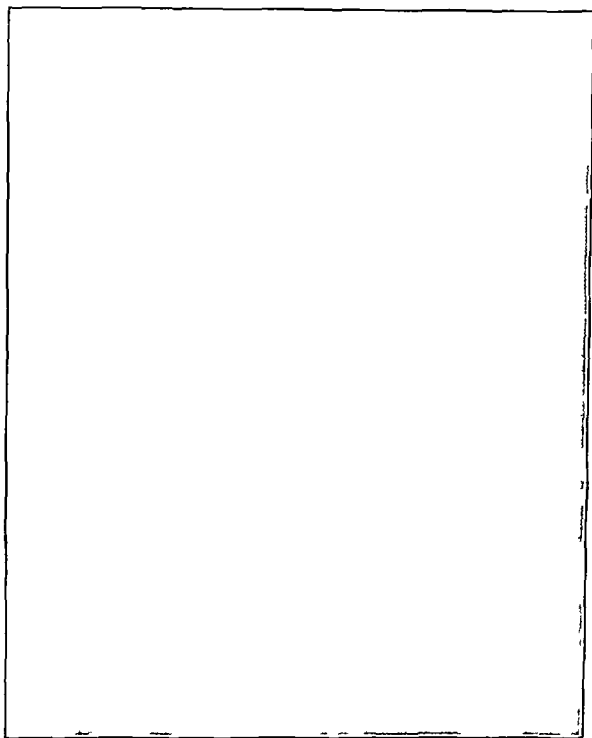
Fig 231 —Diagram of patient on admission showing absence of upper end of the humerus

the sternal The tendon attachment was severed, so that now the muscle lay quite free but for a pedicle which contained the vascular and nerve supply The detached muscle was swung outwards over the bone graft, and attached to the acromion process and clavicle above by a few points of suture Below it was sutured to the periosteum and soft tissues round the humerus in about the position where the normal deltoid is inserted

The clavicular portion of the pectoralis major has successfully replaced a deltoid destroyed by injury, good abduction of the arm resulting , but in the present case, as ankylosis of the bone graft with the scapula was aimed at, the muscle graft was used merely to give ample covering to the bone

The skin flap was now sutured in position and the undermined margins were brought into line The operation occupied two hours

The arm was carefully immobilized on an abduction splint The stitches were removed in a fortnight, and the splint was replaced by an extensive plaster casing

For three months rigid immobilization was insisted upon, as is the custom, and afterwards slight stresses and strains were permitted in conjunction with massage and active movements to stimulate growth in the graft

The behaviour of the bone-graft in this case illustrates many interesting points The growth is seen in the photographs taking place at the side of the graft remote from the periosteum The skiagram taken three months after operation (*Fig* 233) demonstrates a condition which gives rise to anxiety in many grafting operations about this period

There is a mottled irregular appearance in the portion not directly contacted with bone, and an alarming loss of density It is difficult to foretell at this stage whether the graft is about to crumble and become absorbed, or whether appearances are deceptive and the loss of density is due to the fact that at first the demolishing powers of the osteoclasts are more apparent in the photographs than is the reproducing capacity of the osteoblasts It must be assumed that the activity of both classes of cells goes on simultaneously in successful cases, the osteoblasts inserting a new brick in the structure as the old ones are removed *pari passu* by the osteoclasts Sometimes, however, in the grafts that fail, osteoblastic action is absent, and this cannot be told by x rays, for bone formation in the embryonic stage is translucent and does not cast a shadow

The photograph taken six months after operation dispelled anxiety for now a buttress of dense new bone could be seen on the medullary side of the graft and the density of the whole had considerably increased (*Fig* 234) The increase of density and thickness was confined to the portion of the graft bearing stresses and strains namely, between the upper end of the humerus and the glenoid cavity

FIG 232 —Skiagram taken immediately after operation four inches of the graft is intramedullary, the upper portion is in contact with the glenoid cavity the coracoid and the acromion

There was firm ankylosis at these two points

Thickening of the portion of graft inserted into the humerus, and also of that portion above the glenoid cavity, is seen in the second photograph, where stresses and strains, if any were distributed over the whole graft, but after ankylosis had occurred at the glenoid and the extreme upper end of the humerus, the intramedullary portion and the portion above the glenoid were inert and absorption is taking place, especially below More active movements and a more general use of the arm were allowed later, and with the movements of the scapula some strain was evidently transmitted to the portion above the glenoid, which became more solid and dense The graft below united beautifully to

the upper end of the humerus, and there was no further use for the intramedullary portion, which is seen attenuated and about to disappear (*Fig* 235)

The condition of the patient before operation is well shown in *Fig* 230, and fourteen months after operation the patient is shown (*Fig* 236) holding a vessel weighing $5\frac{1}{2}$ lb at arm s length during a time exposure   He can use his arm freely, and almost place his hand to the back of his head   The scapular movements are increasing in range, and the muscles of the upper arm have recovered

FOURTEEN POINTS ABOUT BONE-GRAFTS

1 A loss of density apparent in a graft as shown by x ray photographs a few weeks after operation is deceptive, and does not necessarily indicate absorption and failure   In the early stages the demolishing activity of the osteoclasts may be more apparent than the bone-producing power of the osteoblasts

Fig 233 —Skiagram 3 months after operation— the period of anxiety   The loss of density in the graft due to the distinctive powers of osteoclasts is more apparent than the regenerative osteoblastic process at this date

2 The final success of bone grafting depends upon the operation of Wolff's law, that is, the graft, stimulated by strains and stresses, changes its internal architecture and external conformation until the required strength is attained   In other words, " the amount of growth in a bone depends on the need for it " (Murphy)

3 To provide the necessary strains and stresses, it is advisable to allow the graft to functionate after preliminary fixation for about three months

4 The periosteum should be left on the graft, because, although not essential, it is the medium through which new blood-vessels enter the graft and the surrounding structures   Furthermore, in removing the periosteum, superficial layers of osteoblasts may be sacrificed even in an adult   A periosteum covered graft is therefore less likely to become absorbed

5 In old ununited fractures with false joints the bone in the 'critical area' (near the site of fracture) is sclerosed and non-vascular, and makes unsuitable soil for that portion of the graft in contact with this area

6 In such cases a graft, instead of exhibiting osteogenetic powers and responding to Wolff's law, may become attenuated and absorbed, or break in the critical area five or six months after operation

7 In the same class of case very prolonged fixation is particularly unfavourable to osteogenesis, to the establishment of blood-supply and bony union   Early movements and the bearing of mechanical stress and strain on the other hand, may lead to yielding of the graft and failure   The problem is a difficult one in the case of the humerus or femur, where strength is essential   Wide resection of the sclerosed bone, with resignation on the part of the patient to a short limb, is the only remedy when non-operative methods fail
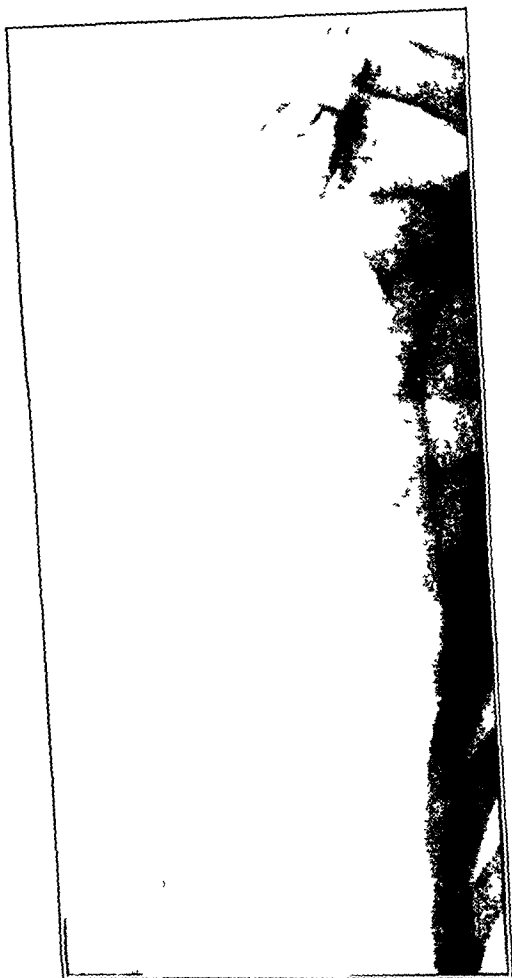
FIG. 34 —Skiagram 6 months after operation There is firm union at the upper end of the humerus and at and above the glenoid cavity   Between these points the graft in accordance with Wolff's law has increased considerably in girth and density   The intramedullary portion is becoming absorbed

FIG 235 —Skiagram 9 months after operation   The graft has replaced the upper end of the humerus   The intramedullary portion to which no strains or stresses are now transmitted has almost disappeared   There is firm union with the scapula

8 A graft must not be used to span a gap in the humerus or femur—it breaks or absorbs   The freshened ends of the fractured bone must be in apposition, and the graft used as a support   This does not apply to grafting of the radius and ulna, nor when a graft is used to replace entirely the lost extremity of a bone

9 But for slightly slower osteogenetic powers the intramedullary peg is effective This method of bone-grafting is satisfactory and simple in practice, although faulty in theory (Fig 237)

10 The bone graft has inherent bacteria-resisting properties   sepsis does not necessarily mean loss of the graft

11 Absolute fixation of the graft in its bed for about three months, secured either as part of the operation, or afterwards by splints or plaster, is essential to success

12 Bone-grafting for spinal caries is followed by more uniformly successful results in adults than is seen elsewhere   This is to be expected, since both the graft and the recipient bed (in the region of the spinous processes) consists of healthy bone

FIG   236 —Patient 14 months after operation holding a vessel of 4 lb   in weight at arms length for a time exposure photograph

13 As in the operation of tendon transplantation and nerve suture, the operation of bone grafting should be preceded by correction of any existing deformity and by the freeing of adhesions in neighbouring tendons and joints

FIG   237 —Section of humerus showing peg graft introduced six month previously   Note the firm incorporation of the graft with surrounding bone

14 Identical grafts behave differently in apparently similar cases, and no emphatic prognosis can be given for many months

BRONCHOBILIARY FISTULA

By ARTHUR H. BURGESS, MANCHESTER

INSTANCES of bronchobiliary fistula being of sufficiently rare occurrence to justify the publication of every case observed, I take this opportunity of reporting the following case recently under my care —

Annie D—, age 59, office clerk, was admitted to the Manchester Royal Infirmary on May 5, 1921 with a complaint that for the previous five months she had been constantly coughing up bile Her history was that on Dec 2, 1920, while walking home from her office, she had a sudden attack of coughing and expectorated some thick white phlegm this recurred frequently during the next three days, and on Dec 5 she noticed the expectoration was of a yellow colour and left a bitter taste in her mouth   With the exception of a few short periods of two or three days each, during which the sputum was white, frothy, and devoid of any bitterness, she has expectorated daily a frothy yellow fluid, varying in quantity from ten to twenty ounces, up to the time of her admission Her sputum had been sent for examination to the Manchester Public Health Laboratory and Professor Delepine had reported it to be pure bile, without pus-cells, blood-cells, or tubercle bacilli , on culture the B coli was obtained , on one occasion a few fragments of food particles were observed microscopically, most probably derived from the throat or teeth At first she denied previous illness of any kind, and even when carefully questioned after operation, in view of the operative findings, all she could recall was that some four and a half years ago she had a headache, with some vomiting of bile, which kept her from her work for a day and a half only no history of abdominal pain or repeated digestive disturbances could be elicited She had never been jaundiced, had never noticed any alteration in the colour of her urine and though of late her stools had sometimes been rather paler than usual they had never been markedly pale   At the commencement of her illness she had lost weight considerably, but for the last three months her weight had remained fairly constant   She had never been abroad

On physical examination of the abdomen and chest, nothing abnormal was found No localized tenderness or swelling could be detected even on deep pressure under the right costal margin or elsewhere, the liver was not palpable and no cutaneous hyperalgesia could be anywhere elicited   She was radiographed on four occasions, but no definite abnormality was noted , once the left half of the diaphragm was thought to move through a less range than the right, but this was not confirmed on subsequent occasions Radiographic screen examination after a bismuth meal showed some atony of the stomach with some dilatation of the first part of the duodenum, but there was no delay either in the emptying of the stomach or in the passage through the intestines   the cecum appeared normal   The urine was clear, acid, sp gr 1010, and free from sugar, albumin, bile and blood   The expectoration varied in colour from yellowish-green to bright yellow, was alkaline in reaction, and frothy   it was coughed up in quantities of about one drachm every ten to twenty minutes, and the frequent coughing allowed her very little rest at night

To sum up   an elderly female, apparently in good health and without any previous illness of note suddenly commenced without any obvious cause to cough up bile, and has continued to do so in amount from 10 to 20 ounces daily for the past five months   Physical examination failed to reveal anything definitely abnormal   A diagnosis was made of broncho biliary fistula of unknown origin, nor was it known with which lung the fistula was connected   The patient herself stated that she had a sensation as if the phlegm came from the lower and front part of the left side of the chest   Bronchoscopy was considered as being likely to elucidate this point, but as its use would, in her nervous condition, have necessitated an anæsthetic it was put aside   As the condition had shown no tendency to

spontaneous improvement, and the patient was getting rather exhausted from the frequent coughing and loss of rest at night, exploratory laparotomy was advised and accepted

Operation, May 28, 1921 —Under ether anæsthesia, administered by the intratracheal method by Mr S R Wilson, the abdomen was opened through a right paramedian incision, the fibres of the rectus being split vertically   The gall-bladder was found contracted thick-walled, and deeply placed under cover of the liver, which was not enlarged , calculi were felt in the gall-bladder and in the dilated common bile duct   There were no adhesions about the upper surface of the right lobe of the liver, but that of the left lobe was everywhere adherent to the diaphragm as were also the cardiac portion of the stomach and the spleen   Better access was obtained by the transverse division of the upper end of the right rectus, and it was then possible, but with considerable difficulty, to free the upper surface of the left lobe of the liver   The extremity of this lobe was inseparably incorporated with a rounded swelling, about the size of a golf ball, having walls of stony hardness , it was densely adherent to the diaphragm above, the spleen behind and to the left, and the lesser curvature of the stomach almost as high as the cardiac orifice   On chiselling through the calcified wall of this swelling, some bile and a quantity of ' biliary mud ' escaped   The dense adhesions between the swelling and the stomach, spleen, and diaphragm were then divided, mostly with the knife, keeping close to its calcified wall , so firmly incorporated, however was it with the liver that the extremity of the left lobe was excised along with it in a V-shaped form, the sides of the gap being approximated with catgut sutures   The raw surfaces left on the stomach and spleen were peritonealized On the raw diaphragmatic surface, owing to its great depth and constant oozing of blood, no actual opening connecting with the lung could be detected, although this was the only possible site of such communication   The common bile-duct was now incised and twelve calculi were removed from it, after which a probe passed easily down into the duodenum and upwards into both hepatic ducts , from the extremity of the left hepatic duct it passed for 1 in through adhesions between the under surface of the liver and the stomach, and was then felt beneath the line of suture in the liver (whence the V-shaped segment had been excised), thus demonstrating the path of communication between the left hepatic duct and the interior of the excised calcified swelling   The gall-bladder, con taining several small calculi, was then removed, a drainage tube sutured in the common duct, and the incision in this duct closed around it   Larger drainage tubes were placed in the right kidney pouch, and down to the raw area on the diaphragm, and the abdominal wall was closed in layers around them   Recovery was uneventful   The two larger drainage tubes were removed on the fifth day, that in the common duct on the tenth day, after which bile soon ceased to be discharged from the wound   There was a steadily-diminishing expectoration of a frothy white character and quite free from bile, for the first ten days She left the Infirmary a month after operation, in good general condition, with the wound soundly healed, and quite free from any cough or expectoration

The most probable sequence of events had thus been—gall-stones in the gall-bladder and common duct, suppurative cholangitis, perforation of the left hepatic duct, formation of a small subphrenic abscess between the extremity of the left lobe of the liver, diaphragm spleen, and lesser curvature of the stomach, adhesion of the left lung to the upper surface of the corresponding area of the diaphragm, gradual inspissation of the contents of the abscess with thickening and calcification of its walls, extension of its lumen upwards through the diaphragm into the left lung, and finally rupture into one of the smaller bronchi, with development of a bronchobiliary fistula   That all these changes could have taken place without causing sufficient constitutional disturbance to have been noticed by, or to have impressed itself upon the memory of, an unusually intelligent patient, seems very remarkable   The final rupture evidently occurred on Dec 2   The enormous thickening and calcification of the wall of the subphrenic abscess stamp it is of very long duration, and it was probably formed four and a half years before, when she had the only disturbance of health she can recall, and that but a slight one— headache and bilious vomiting—for which she stayed away from her office for a day and a half only   and even then was not confined to bed   The gall stones must necessarily

have been of still longer duration and were unassociated with any of the symptoms of 'flatulent dyspepsia' so frequently noted in cases of cholelithiasis

The first collection of cases of bronchobiliary fistula was made by Courvoisier,[1] and consisted of 24 cases, 6 of which were seen only during life and recovered, and 18 seen at autopsy, of the latter, 10 were due to cholelithiasis, 6 to echinococcus cysts, and 2 to ascarides. In 1897 Graham[2] collected 11 further cases, including 2 of his own—1 due to gall-stones, and 1 caused by a kick from a horse, with rupture of the diaphragm, of the other 9 cases, 2 were due to an echinococcus cyst and 7 to cholelithiasis. Isolated cases continued to be published, and in 1912 Ido and Yasuda[3] collected 49, including one of their own, which during life had been considered to be due to syphilis of the liver, but at autopsy the changes were considered to be the effects of gall-stones, although none were then actually present. A search of the literature has yielded me only two cases published since Ido and Yasuda's paper which I epitomize —

Roper's Case[4]—Widow, age 56. In September 1910, had typical attacks of biliary colic. February, 1912, had right sided pleurisy. March 16, in the course of ordinary cough, began to expectorate bile, as much as 20 oz in the twenty-four hours. The liver was palpable 2 in below the ribs and was hard. On April 9 laparotomy was performed, and an impacted gall stone in the common duct was removed by incision of the duct with suture. The gall-bladder was opened and drained, and two calculi were removed from it. The patient recovered

J E Stumpff's Case[5] (For the translation of this paper I am indebted to Dr Murk Jansen of Leyden)—Stumpff reports a female, age 50, mother of three healthy children, suffered from attacks of biliary colic from 1903 to 1907
OPERATION, *Dec* 19 1907, showed perforation of the gall-bladder, with considerable infiltration along the common duct. Cholecystectomy was performed, with gauze drainage, wound discharged for two months then healed
June, 1912, she had diffuse bronchitis with blood stained expectoration, spleen and liver were both enlarged and firm, albuminuria, 5 per cent
Aug 24, 1912, was knocked over by a bicycle, three days later had severe pain in the right side, and coughed up large quantities of thin yellow frothy mucus, and the stools became colourless. Afterwards days of expectoration of bile alternated with days free from such expectoration
Sept 16, right pleurisy with effusion developed, but the fluid was free from bile, eleven days later expectoration of bile finally ceased
Nov 14, death occurred after two days of peritonitis. An autopsy showed diffuse peritonitis, apparently extending from a pyonephrosis, extensive adhesions of both right lung and right lobe of liver to the diaphragm. Careful dissection of these adhesions disclosed a small cavity, the size of a pea at the posterior and upper surface of the liver in the midst of the adhesions, it contained bile stained fluid and communicated with both a bronchus and the bile ducts. The main bile ducts were much dilated, and the lower end of the common duct was completely obliterated. A narrow fistula existed between the common duct and the duodenum just beyond the pylorus. In the common duct were several small calculi and some bile-sand, the calculi being just sufficiently large to produce intermittently complete blockage of the fistula

Altogether then, including my own case, we have 52 recorded instances of bronchobiliary fistula. The etiology in 46 of these is definitely known, since they came either to operation or autopsy. Of the remaining 6 seen during life and recovering without operation, 1 was thought to be due to cholelithiasis, 1 to syphilis, 3 to suppurating hydatid cysts and in 1 no cause was known. Of the 46 cases of known etiology, 29 were due to cholelithiasis (63 04 per cent), 10 to echinococcus cysts (21 7 per cent), 5 to abscess of the liver (1 idiopathic, 2 due to amoebic dysentery, and 2 to ascarides in the bile-passages), and 2 to trauma—Graham's case of horse-kick, already mentioned, and Tyrman's[6] case of gunshot wound. Laceration of the diaphragm is an essential feature of the injury in these traumatic cases

No case is reported of primary lung disease leading to a bronchobiliary fistula

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TRACTION FRACTURE OF THE LESSER TROCHANTER OF THE FEMUR

By H POSTON, MANCHESTER

AMONGST the fractures which are caused by strong muscular contractions is the rare traction fracture of the lesser trochanter of the femur An example of this injury has recently been observed at Ancoats Hospital, Manchester, and I am indebted to Mr Platt for permission to publish the notes of the case

W A , a boy, age 14, was brought to hospital on Nov 1, 1920, with the following history Whilst playing football three days previously, in the act of kicking the ball with his right foot he felt something crack in the right groin He dropped down and was carried from the playing field From the moment of injury he was unable to walk When seen in the out-patient department he complained of severe pain referred to the right inguinal region when he assumed the upright position, and aggravated when he attempted to bear the body weight on the injured limb

On examination of the joint no obvious external abnormality was detected There was some slight tenderness on palpation in Scarpa's triangle , passive movements at the joint were all free Whilst patient was placed in a sitting position with the thigh at right angles to the trunk, he was unable to flex the thigh from the right-angled position This phenomenon—Ludloff's sign—aroused suspicion of avulsion of the lesser trochanter of the femur, and a diagnosis of this condition was made An x ray examination (*Fig* 238) showed, in the region of the lesser trochanter, a detached piece of bone drawn upwards The diagnosis was thus confirmed

The injured limb was encased in a plaster spica with the thigh flexed at the hip to 75° After fourteen days, during which time patient was on crutches, the plaster was removed and the patient given massage and passive movements Seen thirty six days after injury he had full functional recovery and was walking without limp or pain An x-ray examination at this stage showed the detached piece of bone close to the old bed of the lesser trochanter *Fig* 239, an x ray plate taken in May, 1921, shows the firm union between the trochanter and the femur

Ruhl,[1] of the Frankfort University Surgical Clinic, has recently made an exhaustive search of the literature of these cases, and, including one reported by himself, quotes a series of 22 cases of fracture or epiphyseal separation of the lesser trochanter Usland ° writing on traction fractures, quotes a case coming under his observation of traction fracture of the lesser trochanter The case under review brings the total to 24

Etiology —The age incidence of the 24 cases is as follows —

Under 10 years	1 case	4 2 per cent
From 10 to 20 years	19 cases	79 2 ,,
From 50 to 70 years	1 case	4 2 ,,
Over 70 years	3 cases	12 5 ,

It will be seen, therefore that it is largely a lesion of the second decade, almost 80 per cent of the cases occurring in young people between the ages of 10 and 20—the injury resulting in epiphyseal separation of the lesser trochanter Those occurring in elderly people are due to rarefaction of the trabecular structure of the lesser trochanter and consequent loss of resistance to violent psoas traction

The constant factor no matter what may be the circumstances of the injury, appears to be in abnormal traction exerted through the psoas muscle on the lesser trochanter when the femur is fixed The mechanism is brought into action by the effort of the iliopsoas

to restore the equilibrium of the body when the latter is suddenly thrown forward or backward This is illustrated by the case recorded by Ruhl Here the patient was jerked backwards whilst in a train beginning to move off He immediately braced himself by throwing the body weight on the left lower limb , at the same time he felt a sudden pain in the left groin, and was owing to the extreme pain, absolutely unable to walk Femen, who has observed one of the cases collected by Ruhl, thinks the cause of the fracture is passive stretching of an already contracted iliopsoas muscle He illustrates this theory by the case observed of a man who, falling suddenly forward, jerked the trunk into an upright position, as a consequence avulsing the lesser trochanter of the right femur

Fig 238 —Skiagram on admission showing detached lesser trochanter drawn upward

Fig 239 —Showing the firm union between trochanter and femur

Symptoms—Pain and tenderness are constant features In all the recorded cases the patients complained of acute pain referred to various points in Scarpa's triangle The situation of the point of maximum tenderness is apparently variable, and it may be elicited in different areas in Scarpa's triangle Ruhl in his essay is very dogmatic on this point He says In my opinion the point most sensitive to pressure lies in the gluteal fold somewhat to the end of the inner third of the fold, between the adductor and flexor group of thigh muscles If one moves from this point in the direction of the femur, the trochanter minor is encountered This point should be examined in suspected cases '

Attention should be paid to this point in examining suspected cases for it is the site of election for the exposure of the lesser trochanter of the femur in open operation

Loss of function was a valuable feature in the cases of Ruhl's series, various degrees of functional disability, from complete loss to moderate impairment of locomotion, being observed   Swelling is apparently not a constant sign   In 20 per cent of observed cases there was swelling and discoloration similar to that observed in fractures of more super ficial bony structures   Jouillard attributes this swelling, very marked in his case, to injury of the medial or lateral, or both, circumflex branches of the profunda femoris Injury to these vessels is possible, but would be attended with very marked hæmatoma production

Passive movements, although painful, are unrestricted   Active movement of the injured limb, especially flexion at the hip joint, is restricted or in abeyance   The inability of the patient to flex the limb at the hip-joint when in the sitting position is considered by Ludloff,[3] of Frankfort, to be diagnostic of psoas insufficiency, and the phenomenon is known as Ludloff's sign   The presence of the sign depends on the extent of the traction fracture   In the case of incomplete trochanteric separation, where the trochanter retains a certain degree of periosteal attachment, or where the displacement is inhibited by the fibres of insertion of the iliacus muscles (which are often prolonged 1 in downwards and in front of the lesser trochanter to be inserted into the body of the femur), a varying range of flexion is possible   The impairment of flexion is the only functional disability for which any anatomical basis exists

Diagnosis—Before the introduction of x-ray examination it is probable that many cases of this lesion were looked upon and treated as fractures of the neck of the femur In each of three recorded cases there was a definite diagnosis of fracture of the neck of the femur   The grounds for this diagnosis were apparently (1) The age of the patient, (2) The position of the limb in external rotation of the leg and eversion of the foot, as found in fracture of the neck of the femur   Against this, in each case where measure ments are recorded, the clinical reports show that there was no shortening of the affected limb, and that no displacement of the great trochanter was observed   The external rotation may be partially explained by the loss of psoas control on the femur   Jouillard contends that the outward rotation of the limb is a reflex phenomenon, due to the inhibi tion of the muscles in the affected area by trauma and effusion of blood in their vicinity, the limb rolling outwards by its own weight

The final appeal for aid in diagnosis is made to the x ray

Prognosis—In cases uncomplicated by other lesions, and in the young, prognosis is apparently uniformly good   In the aged, when this fracture occurs, there seems to be every reason to believe that, after the initial shock is countered, and suitable—preferably ambulatory—treatment is early established   the result should be equally satisfactory In the recorded cases the treatment was varied , but in spite of the variations the patients all attained good functional results   Five cases of the series were treated by extension and massage, Verschutz giving as the reason for the extension that this position permits the absorption of the effused blood

It is obvious that, owing to the contraction of the psoas muscle, the only treatment which will secure accurate apposition and retention of the displaced trochanter is fixation by operation   This treatment, in view of the results obtained by less drastic methods, is undoubtedly heroic   The method of treatment adopted in my case is simple, yields a perfect functional result, and can be carried out with the patient under regular observa tion in a hospital out-patient department

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THE OPERATIVE TREATMENT OF CLOSED FRACTURES OF THE LONG BONES BY METAL BANDS, WITH A DESCRIPTION OF A NEW INSTRUMENT.

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INTRODUCTION

DURING recent years much thought has been given to the operative treatment of fractures At first discussions centred round the mechanical aspect of such treatment, some preferring the osteosynthesis obtained by extraperiosteal means (Parham-Martin bands, wires etc), others the union maintained by screws nails, hooks, etc , penetrating the bone itself Very soon the problem became complicated by the perfection of sterilized bone-grafts, Albee in America and Nageotte in France leading the way, this work being stimulated by the researches of Leriche and Policard,[22] which seemed to discredit fixation by metal plates, whether fixed by screws or bands (as giving rise to the formation of necrosis and superficial sequestra) Later still operative treatment was shown to be a factor in delaying consolidation, the traumatism of the intervention itself being the cause In the present article we present the results of research into the immediate and remote effects obtained by the use of Parham's bands applied alone in cases of oblique fractures, but associated with plates of metal or bone in transverse fractures

We desire to express our indebtedness to M Pierre Duval, Professor at the Faculty of Medicine of Paris for facilities of research and clinical work, and also for access to the records of his clinic which he most kindly put at our disposition

We first directed our attention to the advantages of, and indications for, the use of Parham s bands, and in this connection especially to the action of metal plates on new bone formation The general indications for the use of Parham's bands in fractures of the long bones have recently been set forth at length by various authors, and may be generally accepted The technique has been well described recently by Digeon,[18] especially as regards muscular interposition, methods of reduction, and the protection of nerves in relation to the fracture We wish especially to claim for Parham's bands several very definite advantages, once the general principles of osteosynthesis by open operation are realized

1 *The Ease of Application and the Simplification of Material used* —The introduction of Parham s bands is extremely simple , the area of application having been chosen, one merely has to pass the hollow curved director described later The armamentarium of electrically-driven saws, screw-drivers, drills, etc , finds no place here But above all, is the reduction takes place little by little under direct visual control one is able to obtain a perfect linear coaptation, and at this moment, and not till then, maintain this union by tightening the band On the other hand, when using plates and screws, it will be admitted that the slightest error in drilling the holes leads to an imperfect coaptation, and to redrill the holes seriously compromises the solidarity of the fragments Therefore, in cases of simple oblique fracture we believe that the metal band is superior to the plate

The coaptation with plate and screw may be perfect , with bands it always is Two points must be noted from the experience of our cases we believe it is a mistake to employ a single band two at least must be used, each placed close to the extremity of a fragment (Fig 240) This is an application of the law of levers , placed at the centre of the fracture (Fig 241) the strength is greatly diminished Nevertheless, one must be careful to leave it least 2 mm between the band and the extremity of the fragment , otherwise the latter may disengage itself from the band, as in two of our cases

In *comminuted* fractures bands are excellent   the band acts as a ferrule, drawing the fragments together, preserving smaller splinters, and forming a veritable 'conglomeration' of bone   Screws and hooks are useless in such cases ,   an alternative is the employment of several or branched plates, but these are objectionable by their multiplicity, and often split the smaller fragments, already numerous enough, and thus prejudice their vitality

Lastly, Parham's bands are equally indicated in *transverse* fractures, if associated with metal or bone plates   We discuss later the merits of these plates

2 Superiority of Parham's Bands to Other Methods of Circular Ligature —These bands are flat, and do not cut or damage the periosteum, as is the case where wire is used ,   the compression is gradual and controlled at will   Wire certainly damages the periosteum severely, and we have seen cases where the bone itself has suffered from the force necessary to retain the fragments   Furthermore, in twisting the ends of the wires, one frequently breaks them, or the twisted ends break off flush in hammering them snugly to the bone   The twisted end may irritate the tissues and cause a fistula in the absence of sepsis   Cuneo has introduced a 'safety knot'   this does not break or twist off, but the end may cause irritation   In any case the reduction and its maintenance by wire is more or less guess work, as com pared with the easy compression and traction given by Parham's bands

3 Early Passive Movement —Early passive movement is the rule in all fracture treatment   Do Parham's bands give any advantage in this respect ?   Martin, of Philadelphia,[6] quotes the case of a patient, operated upon for fracture of the tibia by two Parham's bands, who became delirious on the night of the operation, left his bed, and walked   no displacement of the fracture occurred   Now there is no doubt that the mere traumatism of an operation does slightly delay union, especially early callus formation   therefore it must be always kept in mind that the maintenance of apposition is solely secured by whatever mechanical means have been employed, and this for rather longer than in non operated fractures   Later the con solidation and union is stronger than in fractures treated by external splints   Now the question of mobilization, we believe, turns upon the length of the lever in question and the force that can be exerted on this lever   Thus —

FIG 240
FIG 241

1 FIG 240 — Bands placed correctly near extremities of fragments
FIG 241 —Bands placed incorrectly near middle of fracture

a In fractures of the *forearm* we allow gentle mobilization at once (second day), the arm in the meantime resting in a plaster 'gutter splint'

b Fractures of the *tibia and the fibula* we mobilize on the fifteenth day, and allow walking with crutches on the twenty-fifth

c Fractures of the *humerus* must be treated with caution, for the humeral lever supports the weight of the arm and the leverage is powerful   Here mobilization is allowed on the tenth day and active movements on the twentieth, the arm in the meantime being merely slung and bandaged lightly to the thorax

d Fractures of the *femur* require much care and judgement   Digcon[18] mobilizes these cases as early as the thirtieth day   we cannot agree with him   Nearly all our accidents have occurred in these cases—bending of the callus, delayed union, etc —and our practice is to keep these cases immobilized for at least fifty days

How should these fractures be immobilized ?   In order to avoid large plasters we began by using continuous extension—bending and angulation occurred   We then tried the large plaster generally used for tuberculous diseases of the hip—exactly the same results took place while moulding the plaster after operation   We believe that the following method gives the best results   A bivalve plaster cast is prepared beforehand and applied to the limb which is maintained in continuous extension   The operation is performed with the thigh resting in the posterior valve ,   when completed the anterior valve is placed in position and the whole cast held together by bandaging

4 What are the Effects of Parham's Bands on New Bone Formation ?—We will now give a brief resume of the disadvantages of metallic osteosynthesis later we present the results of a study of cases upon which re-operation was necessary for various reasons, and of the study of a series of radiographs taken at various intervals from the time of operation to several months later

Leriche and Policard[21] made recently a careful study of 15 cases of osteosynthesis by means of Lambotte's plates, but the fact must be noted that in all these cases the plate was placed *beneath the periosteum* According to these authors, microscopic examination shows a certain amount of fibrous tissue external to the plate Around the plate there is sometimes a sheath of new bone, while beneath it the bone immediately subjacent is dry, white and avascular If the plate was removed early (20 to 90 days) they found an extremely thin lamelliform sequestrum Further investigation showed an ischaemic necrosis, and, deeper, the bone in the process of rarefaction The central callus was slow to appear, and poor at that, and the tissues were impregnated with iron salts Millet[22] repeated the researches of these investigators and confirmed their findings, he attributes this superficial necrosis to ischaemia, produced by compression and the destructive action of the body fluids attacking the metal This writer states further that the plate is rarely covered by new bone Albee[11] says that metal plates have no place in osteosynthesis In the presence of these changes one easily understands that consolidation is delayed if metal plates are used

Hallopeau,[19] Dujarier,[20] Fredet et Ronvillois[16] vigorously attacked these observations, from the clinical point of view, bringing forward their statistics and results Hallopeau quotes an interesting case of a double symmetrical fracture in the same patient one fracture was treated by Parham's bands, the other by external splints Clinically the former consolidated very much more rapidly

Cunco and Rolland[23] examined the action of metal in the tissues, and the tolerance of the latter to the former They found that the organic iron salts formed had no deleterious action on the tissues, bony or otherwise

With this preliminary, we now proceed to give our own results, as shown by clinical investigation, radiographs, and the microscope in cases where we have used (1) *Parham's bands alone*, or (2) *Parham's bands associated with plates*

1 **The Employment of Parham's Bands Alone**—An examination of radiographs taken in series shows, as early as the fifteenth day, irregular shadows, more or less opaque, completely surrounding the operative area and band These shadows become increasingly distinct, till, by the twenty-fifth day, they extend longitudinally along the bone, the appearance being that of a spindle or tapering sheath

In certain cases—especially in the tibia, clavicle, and bones of the forearm—the shadow remains more localized and does not extend along the bone In other cases— the humerus, and especially the femur—the callus is excessive, but if radiographs, taken at the expiration of several months, are examined, one nearly always sees a distinct thinning of this callus while in many cases it is reduced to a minimum

Further these radiographs show that the callus surrounds and covers the band, contrary to the assertions of the opponents of metallic plating, but we would call special attention to the small clear area, well seen in *Fig* 262, between the callus and the band This demonstrates that, in immediate contact with the band, early ossification is delayed but radiographs show that later this clear space disappears On the other hand, Fredet has seen this space persisting at eight months

Radiographs taken in profile and anteroposteriorly after the callus has thinned out and settled down reveal at once an irregularity in its development it is always far better developed and more abundant on the side of the bone opposed to the track of operative approach Hallopeau[19] has confirmed this, and believes that the mere exposure of a fracture by operation delays union

In two of our cases (femurs) we were obliged to re-operate for pain In both these cases essentially the same conditions were discovered, a bony mass completely hiding

the bands   After chiselling away this callus, the bands were found completely embedded and firmly fixed   The bands, which were of soft steel, were covered with a black, slightly adherent layer, but no trace of rust was found, and no sequestrum   The tissue was extremely vascular, and the steady oozing could only be controlled by irrigation with hot saline solution   The new bone was more developed on the side of the fracture opposed to the wound, and was moderate in amount

All authors have insisted that callus is more abundant in fractures treated by metallic osteosynthesis than by simple reduction   From this point of view it seems to us that Parham's bands give better results than other metallic appliances, but here we must again emphasize the fact that when using plates (Lane s or Lambotte's) and other methods of fixation (nails, screws, or hooks) the periosteum is always incised and the metal placed beneath it

We believe that the interference with the periosteum, however carefully carried out, explains this trouble with callus formation   Now Parham s bands are always placed extraperiosteally   To the objection that the sensitive and vascular periosteum is traumatized and strangled, we reply that it is of little importance   We have only twice seen cases of persistent pain necessitating the removal of the bands, and as for strangling the periosteum it can matter little, for the blood-supply of this membrane is not longi tudinal and continuous, but of the type of intestinal vascularization, by means of abundant and fine anastomoses   Furthermore, the bands in no way interfere with the periosteum at the line of fracture   it is here intact, while finally, all research, from Macewen to Gallie and Robertson,[24] shows that the periosteum is a vascularizing membrane primarily and takes no part in actual bone formation apart from this property, important though it be

Summing up   our study of cases treated by Parham's bands alone shows —

a A delay in consolidation hardly appreciable even if it exists

b Complete absence of necrosis at the point of contact of the bands

c A callus formation which is regular, reduced to a minimum, and completely surrounding the bands

d An absence of pain, and perfect toleration of the bands by the tissues

e Absence of rust or toxic action by organic iron salts

2 The Employment of Parham s Bands associated with Bone or Metal Plates in Transverse Fractures —Parham s bands find an application in transverse fractures if associated with metal or bone splints   At the beginning we used the metal plates to hand, namely, those of Lane or Lambotte, later, to obviate the bands slipping from the plate, we used Sherman's plates provided with grooves to receive the bands   Later still, bone grafts (living and dead) having come to the fore, we used Parham's bands to fix various forms of bony splints   We wish first to submit certain points which we have found essential in the general technique of osteosynthesis, and then to describe the methods and material which have given us the best results

a METAL PLATES AND PARHAM'S BANDS —We have no hesitation in saying that Sherman s plates are far superior to all others in this combination   Extremely strong, they nevertheless present a very limited area of contact with the bone—a great advantage—at the same time being provided with grooves which render slipping of the bands impossible if the technique is correct   Lambotte's plates have been made with grooves, but being much thinner they necessitate a larger area of bone contact to give the necessary strength, which is unfavourable to the vitality of the underlying bone   We have already

Fig 212 —Diagram shown, points (A B) at the edge of the plate where the band is liable to snap

shown the advantages and disadvantages of metal plates, which are still under discussion, but upon one result of the use of such plates everyone agrees—the volume of the callus formed   Now in the femur the tibia, and the humerus this excess of callus is of little or no importance, but it is otherwise when the clavicle or bones of the forearm are in

question   In these bones the exuberant callus is so disadvantageous, and may cause so much trouble, that we believe Parham s bands with plates to be contra-indicated if the fracture is distinctly transverse, and employ for prefer ence either Dujarier's hooks, or drilling and wire

What are the results of bands and plates ?   We have had several failures, bending of the callus occurring on mobilization   Can these accidents be explained or remedied ?   First, the tissues encircled by the bands are not homogeneous   the resistance offered by the bone and the steel plate is not the same, and there is no doubt that during the few days following operation the encircling force slightly diminishes, whether it be that the plate sinks into the periosteum, or that the band slips more easily on steel than on bone   We have certainly seen cases where the plate has slipped on the band   Another observation is that with mobilization the band may break, and we believe the reason to be as follows   The band after encircling the bone passes on to the plate (Sherman's), which is quadrangular, and in so doing bridges a very small triangu-lar space between the former and the latter, it snaps at the edges of the plate (*Fig 242, A, B*)   This might be avoided by altering the form of the plate   We observed as an illustra-tion of this the case of a young girl who was moved from hospital to her home because of a scarlet fever epidemic   During transport both bands broke and the callus bent   Continuous extension produced perfect alinement, and on the seventieth day the plates and bands were removed from a mass of new bone which *com-pletely surrounded them*

FIG 243   FIG 244   FIG 245

FIG 243 —Oblique fracture requiring two bands only
FIGS 244 245 —Transverse fracture, requir ing four bands
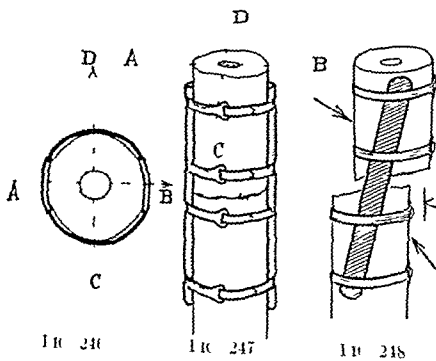
FIGS 246 247 248 —Diagrams illustrating incorrect po ition of plate at oppo ite poles of the ame axis (A B)   The axis at right angles (C D) is unprotected and di placement is liable to occur

There is a great difference in the mechanical distribution of the force which may be applied to *oblique* or to *transverse* fractures In oblique fractures the force is distributed in the length of the bone and in the direction of the weight applied, while in transverse fractures the maximum and optimum resistance of a plate is to force applied perpendicularly to it, a parallel force tending to cause displacement   We therefore use *long* plates fixed by *four* bands   two close to the line of fracture, two towards the extremity of the plate (*Figs 243, 244, 245*)   In fractures of the femur, where the fixation appliance has to withstand considerable strain, it is wise to use *two* plates   These plates should never be placed at the two extremities of the same axis (*Figs 246 247, A B*), because an axis with feeble resistance (*Figs 246, 247, C D*) will be left unguarded   They should, on the contrary be placed each at the extremity of two axes perpendicular the one to the other (*Figs 249, 250 A C*)
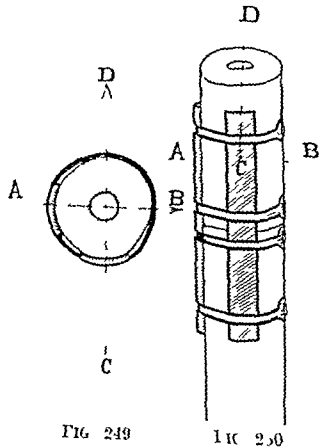
FIG 249   FIG 250

FIGS 249 250 —Diagrams illustrat ing correct po ition of plates at the extremities of two axe (A B C D) at right angles to each other

b BONY SPLINTS AND PARHAM S BANDS —Stimulated by the remarkable work of Nicotte and Sencert on the revit lization of tissues sterilized in alcohol, a large number

of surgeons attempted the use of sterilized bone transplants in human surgery   Although these bony transplants were totally different from the tissues used by these authors, both in their clinical behaviour and histological character, it was nevertheless hoped they would be vitalized and organized by the invasion of osteoblasts from the adjacent bone ends   Gallie and Robertson[24] have recently shown by careful experiment that boiled bone may be thus invaded, vascularized, and absorbed, while at the same time new bone is formed

We have had some experience in the use of bone transplants as splints with Parham's bands, and we now present our results and conclusions   By the courtesy of Professor Pierre Duval we are also able to bring forward the results of several of his cases, observed by ourselves   Duval used bone plates sterilized in alcohol in the form of a shuttle, resembling a Lambotte plate, provided with grooves for the bands   this plate was always placed *upon* the periosteum (*Fig* 251)   Hallopeau[19] uses a sterilized beef-bone plate some 10 to 12 cm long, triangular on section, but with a rounded back, this plate also carrying four grooves for the bands (*Fig* 252)   Heitz-Boyer prefers a sterilized bone plate or splint resembling that of Hallopeau, but bearing lateral ridges which are destined to rest on the edges of the groove cut in the bone (*Fig* 253)   In the cases of the two latter plates a groove has to be cut to receive them into the bone at the site of fracture by means of an Albee saw

Of Duval's cases, 9 consolidated and were satisfactory , in 2 a fracture of the plate occurred , and in 1 case severe infec tion took place , the wound was re opened and the plate removed   The latter lay loosely on the bone and was soiled with pus   In each case where the bone plate broke, re operation was necessary and the plate was removed   In no case was the plate incorporated with the living bone No vascularization was seen , on the con trary, the bone appeared rarefied in contact with the plate, which was roughened but not surrounded by callus   the callus was well developed on the opposite side of the bone   In short, the plate was free and independent, both superficially and deep The plates after their removal were examined

FIG 251 —
Duval's bone plate

FIG 252 —
Hallopeau's bone plate

FIG 253 —
Heitz Boyer's bone plate

by the kindness of Dr Rolland, who reports that " histological examination shows that no invasion of osteoblasts from the neighbouring bone has taken place   there is no trace of commencing absorption, nor is the graft vascularized '   Thus the conditions found where bone plates have been used are essentially the same as described by the opponents of metallic osteosynthesis   As to the cases which consolidated well and in which a good result was obtained, we found the same fusiform callus formation as when metal plates were used, especially developed on the side of the bone opposed to the plate, and in about the same period of time

Our results, then, with bone plates have not been encouraging , but in view of the work of Gallie and Robertson we wish to emphasize that the bone was heterogenous, devoid of periosteum, and dead   In Nageotte s work he insisted on the employment of *embryonic* connective tissue, which condition the bone of an ox does not satisfy

Lastly if one hopes for vascularization, absorption, and osteoblastic invasion of the graft, it should undoubtedly be placed beneath the periosteum, while a great advantage of Parham s bands is their extraperiosteal position   To satisfy both these conditions would injure and compress this membrane seriously compromising the result

We therefore conclude that bone plates give no advantages from the point of view of consolidation they lack the necessary resistance and solidity, and are apt to break The operation is much more complicated if one uses bone splints, which need a groove for their reception they are not incorporated in the callus, and are not converted into living bone For these reasons it seems to us that bone plates are not preferable to those of metal, attractive as they may be in theory

Instruments Required for Parham's Bands —Those used by Parham and Martin are a tractor, an aneurysm needle to which the band is attached by a ligature, and bands of soft steel These, with the operative technique, are well described by Digeon [18] They have many disadvantages Firstly, the method of passing the aneurysm needle and drawing the attached band through after it is clumsy and difficult Where the needle passes, the band may not be able to follow , it becomes caught in the tissues, loses its direction, and twists Frequently the ligature between the needle and band breaks Tanton,[17] in face of these difficulties, invented a 'needle' provided with a hook for the 'eye' of the band but, although an improvement his 'needle does not pass easily One of us (J G) devised a hollow aneurysm needle ('rail passe lame'), which seems to us to overcome the drawbacks of previous instruments (*Fig* 254) It consists in a hollow curved director, at right angles to its handle, and made in two sizes This director having encircled the bone at the selected point one introduces the band at the extremity of this instrument, which thus forms a tunnel through which the band slides The director is withdrawn, leaving the band in accurate position The latter must now be tightened here, again the tractor used by Parham is not all that could be desired, the band frequently twisting and slipping and necessitating manœuvres prejudicial to asepsis Fredet[16] suggested a long band with a running knot at the centre tightened by traction with pressure forceps, a useless and tiring process

Putti' has invented an excellent instrument, but we prefer that of Gatellier The threaded stem of the tractor ends in the form of a shell nose cap' (*Figs* 255, 256 257), which exactly fits into the hollow extremity of a cylinder containing this stem The latter at its extremity is provided with a slit the exact size of the band The band passing through this slit, meets in exactly similar slit in the 'nose-cap' traversing the latter it now meets a cam which lifts the moment the slot of the band engages the former a spring snapping back the cam into the slot The band can now be tightened round the bone by a wheel acting on the stem, while the slot is disengaged from the cam by slight pressure on a button

FIG 254   FIG 255   FIG 256   FIG 257

FIG 254 255 256 257 —Gatellier s instruments for use with metal bands

The apparatus takes to pieces readily for sterilization, and is re-assembled without screwing   It has given us every satisfaction, and is used in the service of Professor Duval
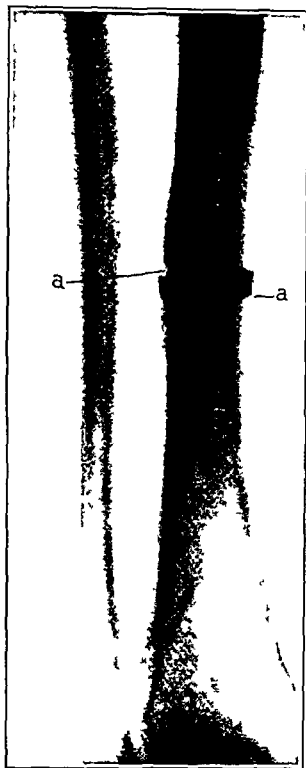
FIG 258 —*Case* 1   Fracture of tibia and fibula eight months after operation   perfect result   *a* Slight construction at band   callus insignificant
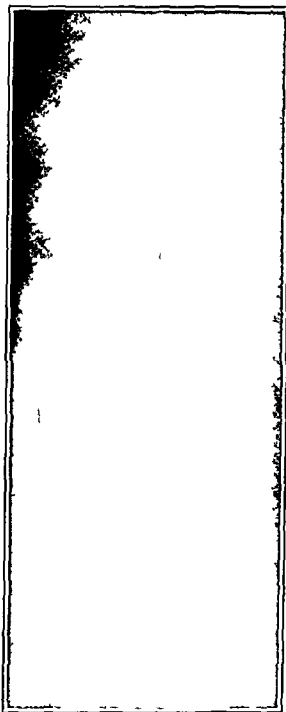
FIG 259 — *Case* 2   Supra malleolar fracture four days after operation
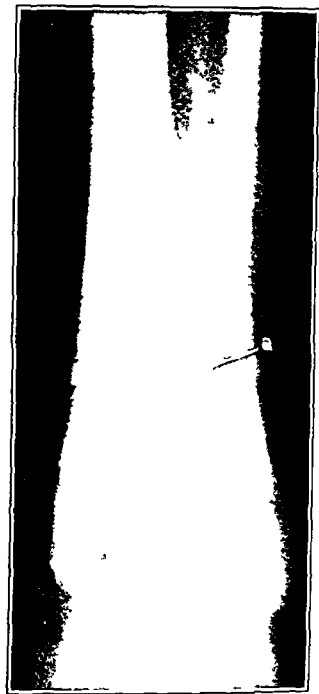
FIG 260 —Same fracture as in Fig 259   eleven months after operation   perfect anatomical result   very little callus   *a* Slight construction at band which is not surrounded by callu

ILLUSTRATIVE CASES

Case 1 —(*Fig* 258) H M , age 40   First seen July 2, 1920   *Operation*, July 5   *Discharged* Sept 9   Oblique fracture of tibia, junction middle and lower thirds, fracture of fibula   Inter position of tibialis anticus   Reduction   Two Parham s bands   *Radiogram*, July 16, showed perfect position   Eight months after, *linear consolidation without appreciable callus*   Anatomical and functional result perfect

Case 2 —(*Figs* 259, 260) L S   First seen Jun 30, 1920, for supra malleolar fracture with marked displacement of tibial fragment   *Operation*, Feb 10, 1 Parham s band produced excellent reduction   Left April 1   *Radiogram* at 11 months shows perfect anatomical result   Minimum of callus   functional result excellent

Case 3 —G T   Supracondylar fracture of femur involving knee joint   Considerable back ward displacement of lower fragment

Operation, Nov 14, 1920   V shaped incision, joint washed out   reduction, and 2 bands   *Radiogram*, 4 months later   showed circular callus enclosing bands, and not excessive

Case 4 —M M , age 32   Fracture lower third humerus   Posterior incision, 1 Parham s band   May 31 1920   *Radiogram*, Dec 4   Excellent reduction   Moderate amount of fusiform callus surrounding band

Case 5 —G H , age 60   Spiral fracture of tibia and fibula in lower third with moderate displacement   *Operation* Oct 6, 1920   Reduction and 2 Parham s bands   *Radiogram* three months later showed good position   moderate fusiform callus formation , bands surrounded with small clear space at point of contact with callus

Case 6 —(*Figs* 261, 262) P C   Admitted Oct 30, 1920, fracture of middle third of humerus, and of both bones of both forearms   Extreme displacement and comminuted fracture (3 pieces)

Operation, Nov 14, 1920, after failure of non operative treatment   Radial nerve freed, bone-ends trimmed, and a Parham's band placed encircling all three fragments
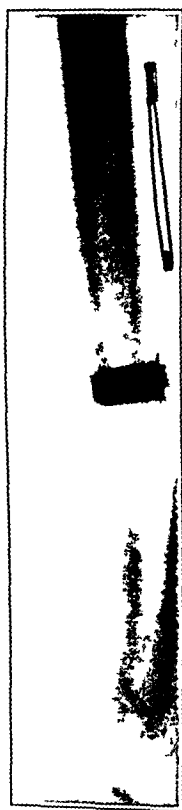
FIG 261 —*Case 6* Fracture of humerus two days after operation
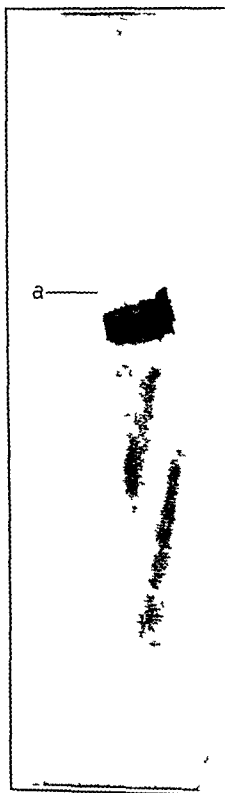
FIG 262 —Same fracture as in Fig 261 seven months after operation   a Large clear space in contact with the band
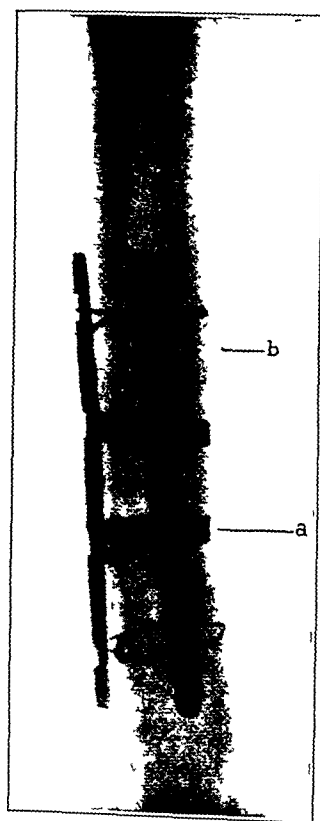
FIG 263 —*Case 7* Fracture of femur three months after operation moderate amount of callus on side opposed to plate   *a*, Clear space   *b* Callus opposite the plate

Radiogram Feb 24 1921, showed perfect reduction and position Three months later, voluminous callus formation with clear space round band Function good

Case 7—(*Fig* 263) D J, age 15 seen Sept 1 1920 with fracture middle third of femur Effusion into knee joint aspirated several times *Radiogram* showed transverse fracture with much displacement   *Operation* Sept 10 Incision through vastus internus and reduction by Lambotte's tractor   Two Sherman's plates and 2 Parham's bands, with 2 wire loops

Radiogram — Perfect reduction Four months later, moderate callus formation especially developed on side of bone opposed to plates   Bands embedded in callus, with small clear space around

FIG 264 —Fracture of clavicle after operation   perfect result

Case 8 —(*Figs* 265 266) G S at junction of middle and lower third   Seen July 7, 1920   Transverse fracture of tibia and fibula

Operation —July 9   Reduction   Sterilized bone plate and 2 Parham's bands

Radiogram — July 11   Excellent reduction and position   Walking on thirty fifth day   Two and a half months later some pain

Nov 2   Bone plate broken, callus formation on side of bone opposed to bone plate, band hidden by callus, and usual clear space round band

Re operation, Nov 3   The two pieces of bone plate lay free, red appearance, and not invaded by new bone   No callus round plate, but entirely on other side of the bone where it was excessive   Bands were covered by callus, but were easily cut and withdrawn   Small clear space around band

Case 9 —(*Figs* 268, 269)   V A Admitted to hospital Sept 11, 1920, with a *transverse* fracture of upper third of thigh, marked overlapping and displacement   Put on continuous extension

Not satisfied with reduction *Operation*, Oct 4, 1920   Bone ends trimmed, 2 Sherman's plates and 4 Parham's bands placed   *Radiogram* Reduction and position satisfactory Wound was closed on account of a serious scarlet fever epidemic Patient returned Dec 7 with bowing of the thigh

FIG 265 —*Case* 8   Fracture of tibia and fibula forty days after operation   bone plate broken callus minimum
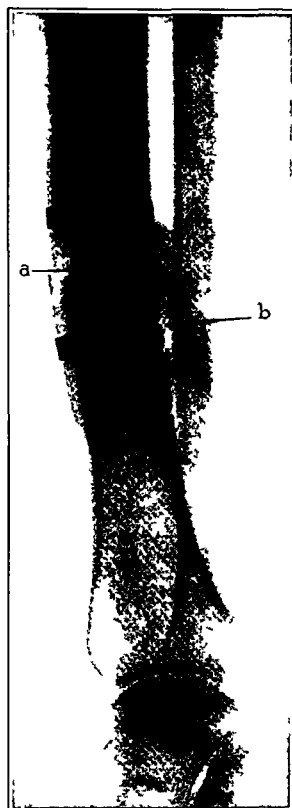
FIG 266 —Same fracture as in *Fig* 265 four months after operation   callus developed on side opposite plate   clear space well shown   *a* Fracture of bone plate *b*, Clear space

Radiogram —The bone is bent , the bands are intact, but one Sherman's plate has slipped from beneath a band allowing this bending   Dec 11, continuous extension applied   Jan 20, re operation   Bands and plates removed   Latter not covered by callus, former well embedded   April 21, *Radiogram*   Sound consolidation , callus moderate in amount, result fairly good

Case 10 —(*Fig* 267)   L L , age 23   Fracture lower third of thigh   Upper fragment displaced externally, and lower markedly backwards

Operation, Sept 20, 1920   Bone extremities trimmed and regularized   *Bone* plate fixed to external surface of femur by 4 Parham's bands   Plaster

Radiogram next day   Very good position and reduction

To note   Technique was bad   (1) Bone plate much too short   (2) Bands too near centre of plate

On the twenty fifth day the plaster was removed for massage   the patient made a sudden muscular effort with the leg, and the bone bent

Radiogram —The bone plate has broken owing to faulty position of bands and powerful leverage overcoming weak resistance of too short a plate   Continuous extension for thirty days produced good result

FIG 267 —*Case* 10   Fracture of lower third of femur   This illustrates bad technique   the bone plate having broken owing to its being too short

Fig 269 —Same case as in *Fig 268*

Fig 268 — *Case 9* Transverse fracture of upper third of femur in which a Sherman plate has escaped from a band, allowing inflexion of the femur
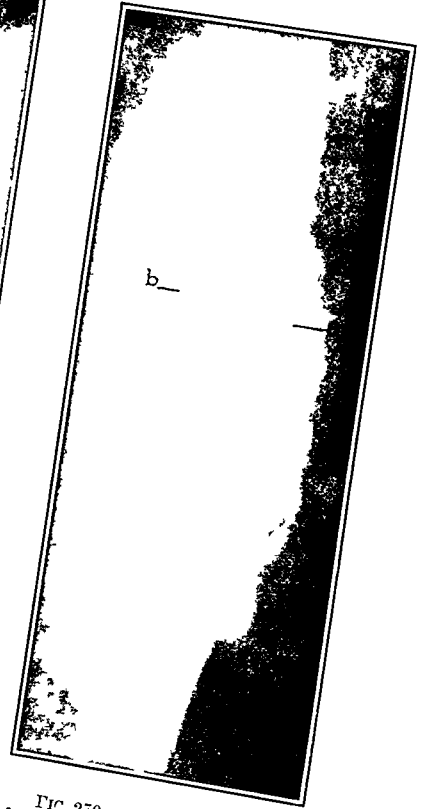
Fig 270 — *Case 11* Transverse fracture of lower third of femur, showing another instance of faulty technique Fixation is bad owing to the employment of two bands only instead of four Sherman's plate too is better than Lambotte's *c b* Clear spaces
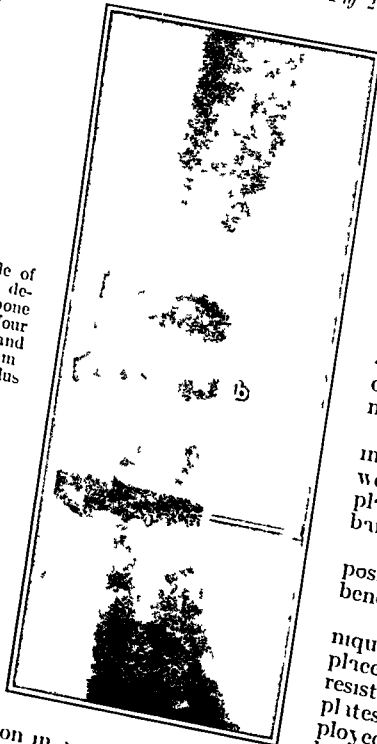
Fig 271 — Another example of bad technique showing callus developed on the side of the bone opposite the plate Here again four bands should have been used and Sherman plate instead of Lambotte a Clear space b, Callus opposite the plate

Case 11 —(*Fig 270*) D F, age 52, seen in consultation April 4, 1920, with transverse fracture of the femur in lower third, with much overlapping of fragments

Operation, April 10 External incision, the bone extremities were trimmed and 1 Lambotte's plate was fixed by 2 Parham's bands

Radiogram —Reduction and position good Bending noted April 22, slight

Observe also the bad technique Two fragments are displaced, the plate only offering resistance in a single axis two plates should have been employed Also four bands should have been used Continuous extension was

applied and resulted in consolidation in a good position by July 1

SYNOPSIS OF THE ELEVEN CASES

Cases 1 and 2 —Perfect anatomical result   Callus hardly appreciable, and linear union

Cases 3, 4, and 5 —Very satisfactory anatomical result   Callus not exuberant, circular and fusiform   Bands embedded in callus, and a small clear area is visible around them

Case 6 —Moderate callus surrounding band , well marked clear space

Case 7 —Two Sherman's plates and four Parham's bands—certain amount of callus on opposite side to plates   Bands surrounded with clear space

Cases 8 and 10 —Bone plates and Parham s bands   Bone plate broken and callus developed on opposite side to plate   Bands badly placed, and bone plate too short to resist

Case 9 —Sherman's plates and Parham's bands   Bands loosened   Plate disengaged and slipped

Case 11 —Limbotte s plate and two Parham's bands   Failure of resistance because only one plate was used (resistance in one axis only)   Faulty fixation by two bands when four should have been used

CONCLUSIONS

1   The simplicity and the ease of application of the Parham-Martin bands establishes their superiority for closed fractures to all other means of operative splinting   Their application is carried out with the minimum of operative manipulation, and perfect apposition is ensured and maintained   They are better than wire for encircling the bone

2   We have been able to observe the remote results of fractures thus treated in cases where we have been obliged to re operate, and in a series of radiographs   They show that the objections made to metallic osteosynthesis, which are very real, cannot be applied to the use of Parham's bands   The consolidation is certainly not delayed, there is no necrosis at the point of contact of the band, and it is surrounded by callus (a small clear space may remain)   Furthermore, any organic iron salts that may be formed have no toxic effect on the tissues , the callus is not excessive in quantity, and is frequently reduced to a minimum   Lastly, the bands very rarely give trouble from their presence and may with confidence be left buried

3   Transverse fractures require to be treated with metal or bone plates (or splints) encircled by the bands   Our results with bone plates have been very disappointing, though we admit Nageotte's principles in theory   and believe the work of Gallie and Robertson to be most valuable, though needing clinical confirmation in its application to recent fractures

We are satisfied with our results with Sherman's metal plates and bands, but our failures corrected our technique   Certain principles in technique must be adhered to if perfect results are to be secured

4   The improved instrument devised by Gatelier which we have described is a great improvement on all others, and is as near mechanical perfection as possible

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VISITS TO SURGICAL CLINICS AT HOME AND ABROAD

THE CLINIC OF DR HUGH HAMPTON YOUNG

THE BUCHANAN BRADY INSTITUTE OF THE JOHNS HOPKINS HOSPITAL, BALTIMORE, MARYLAND, U S A

WHEN the Johns Hopkins Hospital was founded thirty years ago, an experiment in hospital organization and medical education was initiated, the success of which is freely recognized throughout the entire medical world   The graduates of that medical school are considered to have obtained the very best of medical educations, and the records of the Johns Hopkins *Bulletin* have been considered for long a treasure house of careful exact, and important scientific research   It is not to be wondered at, therefore, that the great majority of medical men visiting the continent of North America endeavour to include in their itinerary a visit to that famous institution

In April, 1913, Sir William Osler was on a visit to the United States   The Peter Bent Brigham Hospital in Boston was then in the process of being built, and although not ready for a formal opening the occasion was considered opportune for the baptism of the hospital which had been founded as the hospital of the medical school of Harvard University, created in the image of its parent, the Johns Hopkins Hospital, and imbued with the spirit of its progenitor, which Sir William Osler had been so largely responsible for creating   Speaking on that occasion, he described the nature of the new scheme of hospital management that was initiated when the Johns Hopkins Hospital was founded —

' At the Johns Hopkins Hospital we made a new departure in hospital management—that is, a new departure in this country—but by no means in medical education, for we simply adopted a combination of German and English methods   In the first place we were paid officials of the hospital   We followed the German system of organization in appointing a head of the service, with a group of house physicians a group of subordinates, and with proper clinical laboratories   And we adopted the English plan of regarding the student as a part of the hospital organization—as large a part as an intern or nurse—of making him feel that he was not in the ward simply as a matter of granting him certain rights but that he was there to get his education as a clinical clerk or surgical dresser   I have always felt that as soon as a student enters the hospital he should begin to get his information just as he gets it when he goes out into practice, by daily contact with patients in the out patient department and wards "

This system of medical organization and its influence on medical education can be studied at its best in the Johns Hopkins Hospital where it was initiated   At the same time most visitors like the author of this article, will be keen to observe how far the success that has attended it is due to the perfection of the organization, and how far it has been influenced and brought about by the unique combination of medical men who were gathered together on its original staff   Some would even be prepared to say that any hospital, however organized that had on its staff such men as William Osler, Welch Halsted, Kelly and Councilman, was thereby certain of success

In our visit to the Johns Hopkins Hospital, and especially the Buchanan Brady

Institute under the care of Dr Hugh H Young, we therefore studied it from two aspects, the first being the perfection of its organization, and the other the influence of the personality of those directing it

If the medical visitor is keen on his profession he is sure of the most cordial and hearty welcome from its staff

Osler once remarked that there were three signs by which fogyism can be recognized in in institution (or man) They are "First, a stage of blissful happiness and contentment with things as they are , secondly, a supreme conviction that the condition of other people and other institutions is one of pitiable inferiority , and thirdly, a fear of change,
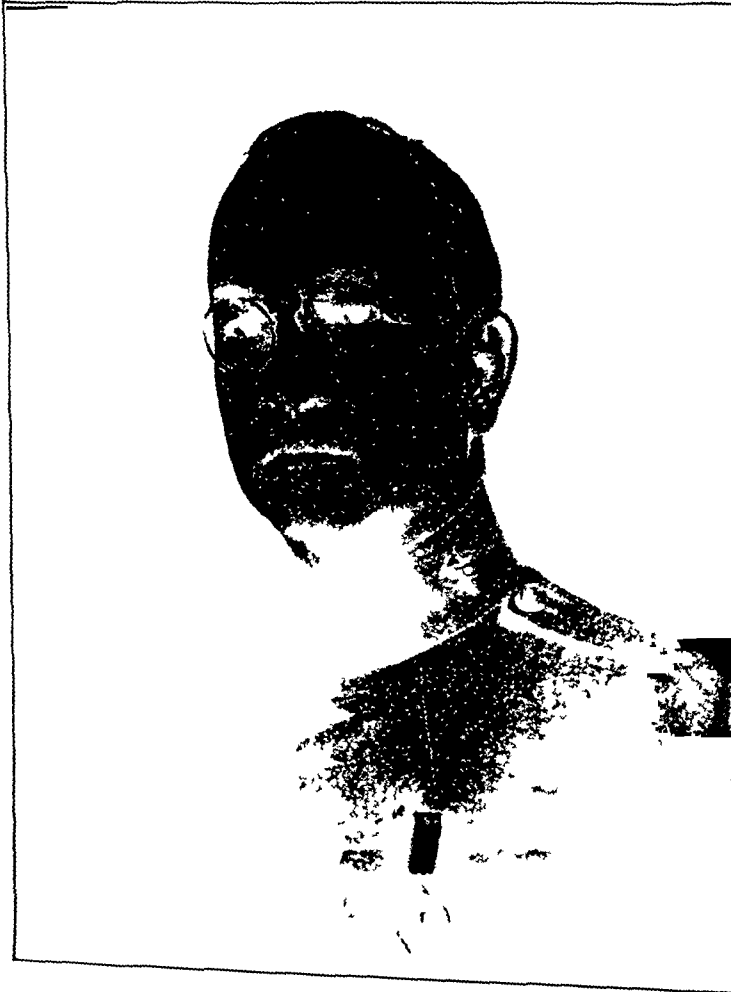
Fig 272 —Dr Hugh Hampton Young

which not done perplexes but appalls ' The spirit of Osler is still evident and although there is much in the hospital that would even justify what has been described is the calamity of self satisfaction, no evidence of this is apparent, and an insistent desire for progress in a forward direction is manifest it every turn

Since the Johns Hopkins Hospital was originally founded, three special departments have been added —the Phipps Institute of Psychiatry the Harriet Lane Department for Sick Children and lastly the Buchanan Brady Institute of Urology, which was opened in 1914 This undoubtedly is the most complete Institute of Urology that exists in any

part of the world   It stands within the grounds of the hospital and is an eight storied block connected with the Urological Out-Patient Dispensary of the Hospital

Entrance to the Institute can be conveniently gained from the main corridor which connects the various wards of the hospital   In passing down the corridor, the visitor reaches the entrance hall, on the left wall of which a portrait of the founder, J Buchanan Brady, is seen   The picture reveals the features of a typical Irish-American, a man of obvious ability, shrewd and genial   The junior students know him as 'Diamond' Jim Brady, a name he is said to have earned for himself owing to a characteristic that the artist has not failed to bring out and that is his fondness for those precious stones   He
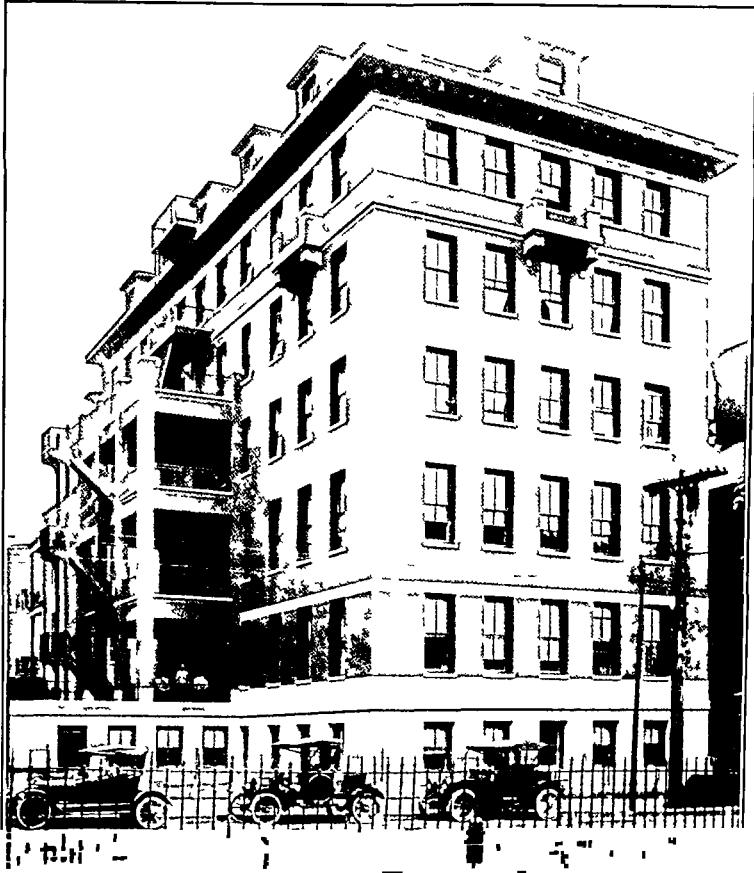
FIG 273 —The Buchanan Brady Institute of the Johns Hopkins Hospital

is said to have made his fortune in railway construction, and in the disposal of a part of it he has undoubtedly produced the most valuable jewel of all his collection

The entrance hall leads to the second floor of the Institute , but in order to understand clearly the plan of the building and the arrangements for its working, the visitor should proceed to the floor beneath where the clinical examination department is situated and from which the work of the Institute is, in the main, directed   On his right as he descends the stair to this floor, is situated the waiting-room for out-patients, and to it patients from the wards above who require cystoscopic or other examinations can be brought by means of the elevator   The arrangements of this department are such that a long corridor extends down the centre, and on the left of it nine rooms are situated

These are mainly arranged for cystoscopic examinations but before entering them the visitor will be met in the corridor by Dr Young's private secretary, and on presenting to him his credentials will be introduced to Dr Young if this be one of the days when he is not engaged in the operating theatre, or with clinical lectures

Dr Young is the director of a highly organized and complex mechanism equipped to execute urological diagnosis and treatment rapidly and accurately It must be difficult to be welded into such a position and avoid becoming metallic in nature, but such we do not find him

In the soft accent of the South you receive a cordial and hearty greeting, and at once you are made to feel at home in your new surroundings The smoothly running machine moves on and as you move with it you observe one of the secrets of Dr Young's success, which is the cordial esteem in which he is held by all his staff, and by his devoted patients He is never too busy to give a sympathetic hearing to the convalescent patient returning

Fig _4 Small public ward

home from his stay in hospital or too occupied to recall old days with a medical colleague whom he last met when on service in France or without time to settle the diagnostic difficulties of the most junior member of his staff One of the latter put the case to me succinctly when speaking of his post-graduate training in various clinics " Whereas , he said with my former chief the difficulty was to get any resident to stay with him, with Dr Young although he works you just as hard the difficulty is to get any of his residents to leave him

Dr Young's staff in the Brady Institute consists of a resident and six interns five associates and assistants in the private clinic six associates and assistants in the out-patient department and four assistants in the purely research department Mr Didusch is in charge of the department of medical art and Dr Waters and Miss Goldthwaite have charge of the radiography department Laboratory technique is under the care of Mr Ivers and the clerical staff consists of his secretary Mr Slade and five stenographers

In addition to this, there are usually from three to five post graduate physician students who remain from one to two years The whole of this staff, including Dr Young who is Director, devote the entire working day to service in the Institute The arrangement with Dr Young that permits of this is one that appears to be in every way ideal, satisfac tory to the surgeon, to the great benefit of the Institute, profitable to the patient, and conducive to the advancement of science , for, gathered under one roof is a complete staff organized and equipped to carry out the investigation and treatment of the patients who are inmates of the public wards, and by a simple and satisfactory arrangement in the same building are situated the private consulting rooms and offices of the Director , and his private patients are accommodated in private wards within the public hospital It thus means that the Director can organize his day's work in a manner that permits of a degree of efficiency in the Institute that could never be obtained if he were concerned only with visiting patients in the public wards for a limited period of the day
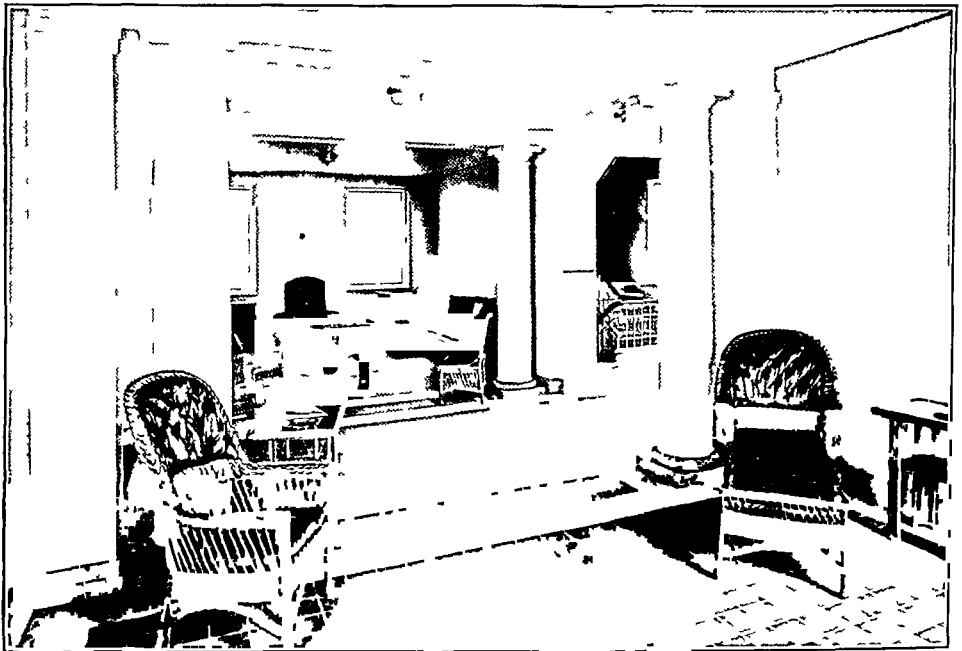
FIG 275 —Recreation room for private patients

As the writer observed it, the system worked out in practice in a manner that revealed the best ideals of a social democracy Whether in the examination hall or in the operating theatre, the claims for priority in dealing with the patients were based entirely on the nature of the ailment from which they suffered and its urgency for treatment The facilities of the Institute for the investigation and treatment of disease were equally at the disposal of all, and all appeared to receive equal care and attention

The interns appointed to the staff of the Institute are all men who have had at least two years experience of general surgery and are considered to be competent operators The resident urologist usually remains two or three years before he becomes appointed, and after that for a further year or more The last two resident urologists have been on Dr Young's staff for five years When it is remembered that prior to taking up the study of medicine he probably has had to obtain a degree in Arts, and that his student course has occupied six years and thereafter two years have been spent in general surgery, and that several years are likely to elapse before he is appointed to the senior

charge as resident urologist, it will be understood how fifteen years may have been spent in preparatory training. On the other hand, it has to be remembered that the vast continent of America lies open to him who has reached such a position, and that when he leaves Dr Young, in all likelihood it will be to occupy the post of Director of some similar Institute in one of the larger medical centres in America

Before considering the organization of the Institute in detail it will be of profit to visit the various departments and observe how they are housed

If we begin with the clinical examination department on the first floor where the out-patients and patients referred from the wards are examined, we find the small examination rooms on the left of the main corridor, as already mentioned. These are so arranged that in one of them a preliminary investigation of the patient's case is carried out by a junior member of the staff, and his case record dictated to a stenographer. He is then referred to one of the special examination rooms, where, the preliminary preparation having been carried out by one of the orderlies in attendance, Dr Young or a member of his staff visits him and carries out the investigation required. As this is being conducted, the details of it are dictated to another stenographer in attendance, and if a special x-ray examination is found to be necessary this can be rapidly executed, as the room is wired for this purpose, and the examination table—invented by Dr Young—that is employed has the necessary x-ray equipment attached to it. The x-ray specialist is therefore requested to attend. The preliminary arrangements for taking the photographs occupy only a few minutes. The exposure is controlled from a lead-lined cabinet outside the examination room, but having a lead glass window looking into it, through which the operator can give the necessary directions without being personally exposed to the effects of the x rays

The rooms to the right of the corridor are mainly allocated to chemical and bacteriological clinical investigations, and here are situated the dark room and viewing room of the x-ray department with the x-ray library adjacent. Communicating with this floor of the Brady Institute but in a separate building, is the out-patient clinic for the treatment of venereal disease. Work in this department is mainly conducted in the afternoon, and like the former, it is equipped completely for its work. It is a separate department complete in itself with the great advantage of close proximity to the Brady Institute, to which occasional cases requiring special investigation can be referred

At the time of our visit Dr Cecil was senior urological resident, and with him were associated Dr Dimming and Dr Jack. Dr Jack, who conducted us over the building, had been regimental medical officer to a battalion of the Devons in France, and with them had served for many months in the line in Flanders

We first of all visited the research laboratories which are situated on the top story. Here we found a staff of whole time chemists engaged in research. At the time of our visit they were investigating especially the antiseptic properties of certain aniline pigments, one of which give promise of being specific for *Bacillus coli* infection. The red pigment known is mercurochrome or 220, which is now being employed extensively through the medical world originated in this department. Its advantages as a disinfectant and its disadvantages as a permanent dye which left a lasting stain on linen or other articles were observed. In the bacteriological laboratories there was demonstrated to us a new method of growing gonococci in oxygen of lowered tension

We then visited the private quarters of the residents, which are situated on the floor beneath, and found them most palatial

The private and public wards on the various stories were also inspected. The private wards consist of single rooms, certain of which have a private bathroom attached. Some of the public wards contain three beds, and a large and airy general ward is situated at the end of the corridor. Adjacent to the public wards are the doctors' side rooms in which the patients' charts and records are kept, these being made in duplicate, one copy being preserved in the department, the other being filed in the general hospital records. There also is in the vicinity a small ward sterilizing room, and it was here observed that the gum elastic catheters used in the wards were sterilized by steam at 60 lb

pressure for a quarter of an hour, the instruments being contained inside stoppered glass tubes   In the basement of the building are situated the animal houses used in connection with the department of experimental research   Here is also located the instrument makers' room, under the care of Mr Hughes   At the time of our visit he was engaged in making several of Dr Young's boomerang needles and the new pattern of cystoscopic rongeur

Usually two forenoons of each week are given over by Dr Young to operating   This is carried out in one of the theatres of the centrally situated operating department of Johns Hopkins Hospital   By means of this excellent arrangement the special department of urology is kept in intimate touch with the general surgical service, thus conferring advantages on the latter, and itself receiving the many benefits of intimate association
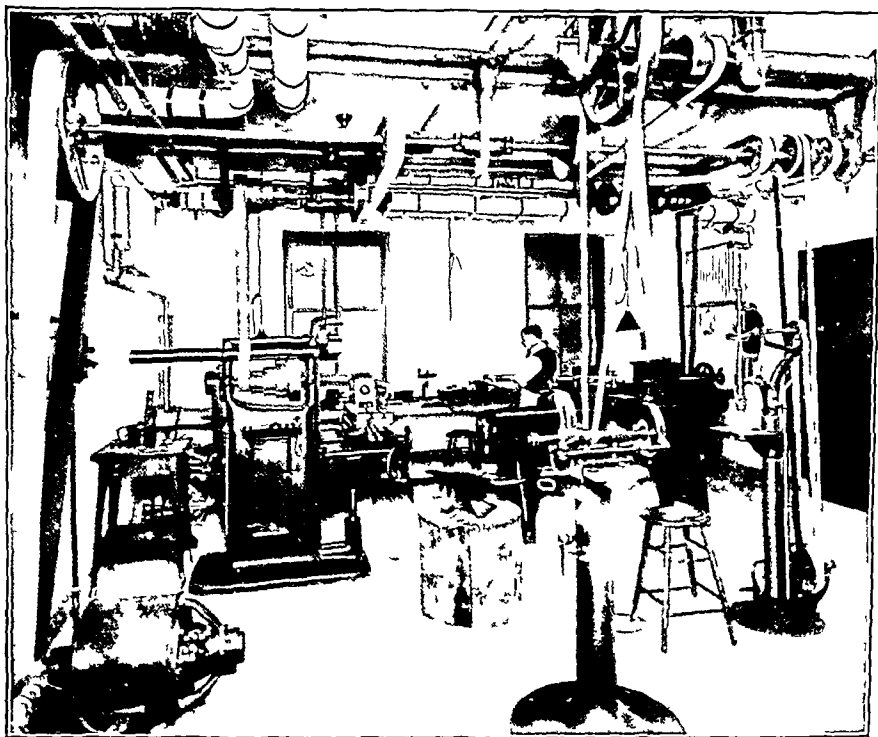
FIG 27C —Instrument makers work hop o the Buchanan Brady Institute

The visitor also benefits, is on one morning when I was in attendance, in three of the adjacent theatres Dr Halsted, Dr Finney, and Dr Young could all be observed at work

The theatre used by Dr Young is well lighted   The visitors after being suitably garbed, occupy seats on a portable steel platform, with their backs to the light, so that an excellent view of the operation is obtained

The anæsthetic is administered by one of the nursing staff under the direction of a lady who is the permanent supervisor of anæsthetics   It is uniformly extremely well given, but at the same time, one could not but feel that this arrangement did not provide the same facilities for instruction for the junior medical student as are afforded where he takes a more intimate part in the administration of the anæsthetic   There can be no doubt whatsoever that the patient benefits by this arrangement—but does the community ?

The operating team consisted of Dr Young, his first or second assistant, one of the interns as third assistant, and another doing the instruments This latter intern is usually the most recent member of the staff, is himself a graduate, and, as has been mentioned his spent at least two years at general surgery before coming to this department The theatre nurse attends to the lotions, swabs, and dressings and one or two male orderlies arrange the patient and may be employed to hold a bougie in position during the operation or on a similar septic service

On several occasions during our visit we saw Dr Young perform his own operation of perineal prostatectomy There is no doubt but that in his hands it is an ideal operation But at the same time, it must be granted it will never become what we may describe is a cottage hospital operation

We also saw him perform more than once his operation for tuberculous disease of the genital tract One of these cases was a man age 40, who had been for five years an inmate of a sanatorium He had healed tubercle of his left lung, and on this account was operated on under a local anæsthetic, cocaine being employed The patient was arranged in the exaggerated lithotomy position on a Young's operating table An inverted V-shaped incision with the angle rounded off was made the incision extending back on either side of the anal outlet from 1½ inches in front of that orifice It was similar to that employed in doing the operation of perineal prostatectomy except that it extended further back The prostate having been exposed, the urethra was not however, opened but Young's seminal vesical tractor which had been previously passed down to the prostatic urethra was now introduced into the bladder its blades opened, and the prostate pulled down Above the prostate the seminal vesicles were exposed and the left seminal vesicle

FIG 277 —Operating rooms in the department of experimental surgery

being found to be the site of tuberculous disease, was very carefully separated from the bladder the vas deferens extending up from it being isolated The vas was now divided a pair of forceps being left attached to the lower end of the portion remaining The wound was then packed with iodoform gauze and closed The next step of the operation was the removal of the diseased testicle, which was separated but for the vas, which remained undivided By a see-sawing motion one hand holding the forceps attached to the vas in the perinæum and the other grasping it in the inguinal canal, the vas was freed and withdrawn

At the conclusion of the operating morning we accompanied Dr Young to lunch and perhaps in no other way could be better illustrated the fine camaraderie of the department than at this function At its best it is a simple meal and if you arrive late you may find little left but here you will meet every member of the staff and hear discussed the latest advances in the science of surgery the latest news from a distant clinic, or even the merits of some well known baseball team Dr Schwartz and Dr Davies, who have come

down from their work in the research laboratories above, hint at discoveries that will soon be made public knowledge, and since most of the younger members of the staff, like Dr J C McClelland, who is now in Toronto, and Dr J A C Colston, who served with the 15th British Division, had served in France not infrequently the conversation turned to the war in one of its many aspects

Dr Young's colleague in the Brady Institute is Dr Geraghty, and he was seen at work in the clinical examination rooms and in the operating theatre   The surgical world knows of him from many of his contributions to the science of urology, but the visitor will probably be most impressed by his wonderful clinical acumen and the soundness of his judgement on any surgical problem   Junior to Dr Geraghty on the permanent staff is Dr Frontz, and under his direction we had demonstrated to us several of those most interesting cases of congenital valves in the prostatic urethra that he has investigated with Dr Young

In one of these, a boy, 'Bobby', we were shown in the examination department the prostatic valve, and later on, in the operating theatre, it was removed   In this case the treatment was carried out by opening the bladder through a suprapubic incision the obstruction being cut out by a specially constructed, small-sized, Young's punch, which was passed per urethram, the blade of it being driven by an electric motor

In such a department, with such a Director it follows as a natural consequence that many medical men who wish a post graduate training in urology are attracted from far and wide   For these a course of training is laid down which demands a high standard of general surgical experience before they are accepted as members of the service, and there after they receive a special urological training, comprising work in the out patient depart ment, laboratory work, and extensive experience in the use of those special diagnostic and therapeutic instruments that are so frequently employed   They are also trained in roentgenography, the taking of pyelograms and cystograms   They are encouraged, and one might say expected, to devote a certain amount of their time to research   It is interesting to learn that this programme, which was initiated in the Buchanan Brady Insti tute has been adopted by the American Medical Association as its own

At the outbreak of war Dr Young was appointed a Colonel in the Medical Corps of the United States' Army, and made Senior Consulting Urologist to the American Expedi tionary Force   He accompanied General Pershing on the *Baltic* to England, and was on service in France until after the armistice   In his case the call of the bugle got a ready response from one who came of military stock, for he is the son of General William Young, and grandson of General Hugh Young, who fought in the Civil War between the North and South   When a lad of 16 years, Dr Young following the family traditions, joined the army, and became a first lieutenant   He soon, however, gave up the career of arms for the profession of medicine   Those who know him best will feel convinced that the same qualities that have earned for him the designation of the 'Galen of urology would have carried him forward to a similar position of pre-eminence in the Army

THE CLINIC OF SIR HAROLD STILES, EDINBURGH

Sir Harold Stiles had assured for himself world-wide recognition before he was appointed to the Royal Infirmary at Edinburgh. He had the advantage of coming to the chief hospital of the city in all the fullness of his powers and enthusiasm. For many years he had been teaching at the Children's Hospital, and from there had published, either himself or through his assistants, his chief works on surgical tuberculosis. He had the Chalmers' Hospital also and there kept his hand in, as it were, on adult surgery. A University Lectureship on Applied Anatomy—to which he was appointed, we believe, on the recommendation of the late Dr J Cunningham—had given him the opportunity of developing an aspect of surgery of which he has shown himself one of the greatest living exponents. Indeed Sir Harold's name is known to the majority of our profession, first, perhaps, as a practical anatomist of the highest class, and secondly as an operator of very great manual dexterity.

It is with Sir Harold Stiles as a teacher rather than as an operator that we have to deal in this article. His teaching reputation has been great locally, owing to his clear-headedness and the lucidity of thought which his mind encompasses. As Clinical Professor his qualities have been given further scope, and he has the opportunity of impressing his stamp on a wider field of assistants and undergraduates. His clinic is a comparatively new one, having been in existence for only two years; for it was in 1919 that Sir Harold was appointed Professor of Clinical Surgery, and given beds in the Royal Infirmary. In this short time he has given ample proof that the magnificent tradition of teaching cherished by the Edinburgh school is being worthily upheld by him and his assistants.

Sir Harold has organized his unit at the Royal Infirmary so that it is very largely self contained. A pathological laboratory, of which his clinical tutor is in charge, has been added; and thither all material obtained in his wards and theatre is referred and there classified card-indexed, and disposed of in such a way that material useful for either teaching or special investigation may be conveniently obtained as occasion arises. The simpler bacteriology is also done in this laboratory, but any special bacteriological investigations are referred to Professor Ritchie's department. Obviously a self-contained laboratory of this kind is of the greatest possible value for the chief of the clinic, and his assistants are thus enabled to lay their hands at a moment's notice on material that they want without making themselves a nuisance to others, or having to search amongst a multitude of specimens useless for their purpose. From this laboratory students are given sections of tumours or inflammatory material taken from their cases in the wards, and are allowed to keep these permanently. From time to time some special investigation will be undertaken for the students. For instance, the cervical glands removed in a case of carcinoma of the tongue will be accurately charted and sections cut from the several glands given out to demonstrate the paths which glandular metastasis may take. Photographs and drawings are made up here for record; and these, together with a quantity of mounted and unmounted specimens make an excellent nucleus for teaching purposes. The staff of Sir Harold Stiles team consists of himself, assisted by Mr D P D Wilkie. Mr Hartley is clinical tutor, on whom most of the management of the class falls; a house surgeon and an unqualified clinical assistant.

Teaching at Edinburgh is done on six and sometimes seven days in the week. From Monday to Friday inclusive Sir Harold Stiles himself attends the Infirmary for classes or operations. It is really very difficult to draw a distinction between Sir Harold Stiles operating and Sir Harold Stiles teaching; the only difference between the two is that

on the one occasion he has a knife in his hand, and on the other he has perhaps a piece of chalk or a specimen—that is to say, he teaches incessantly, and describes the anatomical steps of all his operations as he goes along The typical time table is —

Monday —A lecture at 11 0 o'clock on some selected subject

Tuesday —A clinic is given in the operating theatre on cases which have been specially recommended to Sir Harold Stiles, and on this day the opportunity is taken to demonstrate the case or cases destined for operation next day that have not already been shown to the students At the same time, cases which have been operated on and which are ready to leave the hospital are also shown The same case will, therefore, very frequently be demonstrated at length no less than three times—before operation, at operation, and after operation The comparative dearth of clinical material at Edinburgh makes this a very valuable plan

Wednesday —Operations commence at 11 o clock in the morning and may go on until 3 o'clock

Thursday —A clinic from Mr Wilkie and from Sir Harold Most of these clinics last for some 2½ hours

Friday —Sir Harold operates again at 11 o'clock

Saturday —Mr Wilkie operates

We have mentioned the comparative dearth of material at Edinburgh , but it must be understood that this is entirely a relative statement Edinburgh is by no means lacking in material, but she does not positively overflow with it in the same manner that some hospitals in the densely populated areas in England do

Further, it is probable that we in Great Britain are making a mistake in allocating too few beds to our leaders of clinics A service of some fifty beds is too small a number to allow the Director to allocate some branches of surgery to one or more assistants, if housing has to be found for them in a small unit On the other hand, it must be admitted that the provision of a large number of beds would cause hardship to one's colleagues and it is no doubt considerations of this nature that have so far prevented the institution of a British clinic on Continental lines One cannot help being interested in speculations as to the results of such a system manned by our own people, and feeling that it would prove not only superior to the Continental models, but also far better than anything that we have to day

Another striking thing about Edinburgh is the extraordinary number of tuberculous cases that have to be dealt with These cases include tuberculosis of all kinds, of bone, of glands, and of the abdomen , also types, such as tuberculosis of the long bones, which are not commonly met with in England

On the day that the writer was present, four cases were demonstrated to the students Stiles is a great believer in teaching from the living body and always, when possible takes for the basis of his discourse some definite case or cases from the wards or out-patients He uses the operating theatre to teach in owing to the large number of students During the three summer months he took the whole of the women students, some eighty in number, and to these were added some thirty male post-graduates The last simply attend the students' lectures and demonstrations in order to pick up what they can from them, as Stiles believes that his first duty is to teach the students However, no post graduate need be put out by this for Stiles clinics are so thorough that it would be difficult for anybody not to pick up hints as the hours go by

The case is brought into the theatre , the two students who have taken notes on the case are now called down, and one is asked to read the notes they have made These notes are constantly interrupted to emphasize the important points which may be of diagnostic and prognostic value The students notes are filed away for reference with those of the clinical tutor These notes are marked by the latter, and a record of these marks is kept on an index-card for each student The index-cards pass from one clinic to another so that at the end of their clinical training a definite record is in existence of

the students practical work, and at the final examination this record may turn the scale for or against the student in doubtful cases This is surely a very admirable method, and one worthy of wide application

The first case shown was one of tuberculosis of the left kidney The history was brought out by question and cross-question and finally, Stiles reviewed the whole case in a judicial summary

When special examinations are referred to, such as animal inoculation for tuberculosis, and cystoscopy, Stiles does not simply mention these things and pass on, but he requires the students to tell him exactly what technique is employed for the inoculation of tuberculosis into animals, what one would expect to find, when one would expect to find it, and what method can be employed to speed up the positive reaction

In a case of cystoscopy the appearance of the bladder and ureteral openings are gone into clearly and concisely Needless to say, a very great deal of surgical anatomy
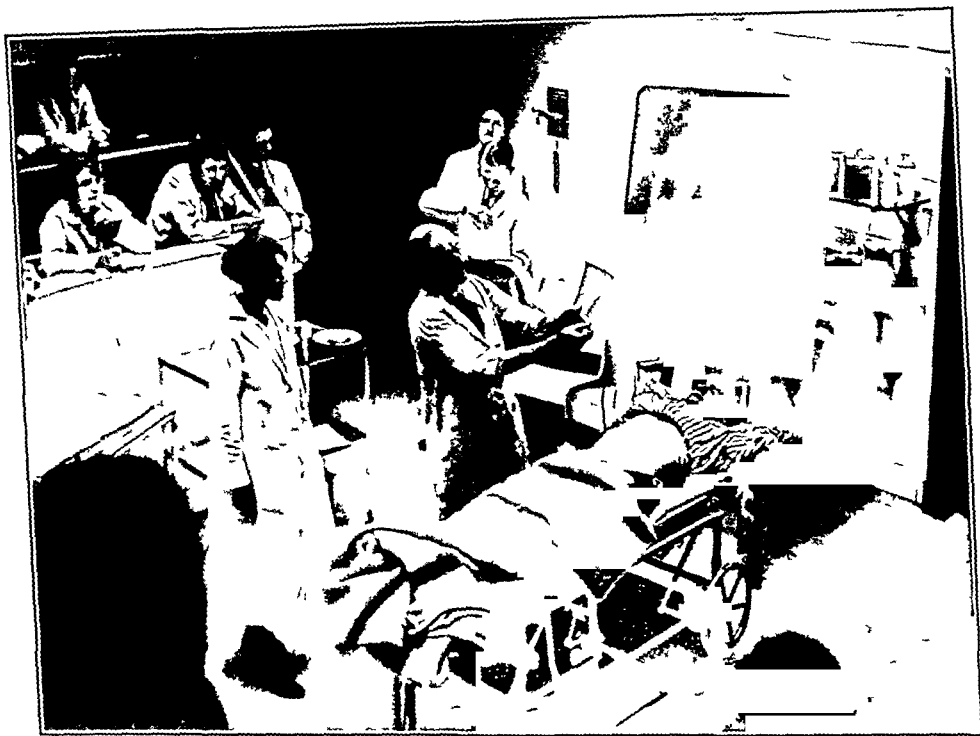
FIG 278 —A clinical demonstration in the theatre

is interspersed throughout the clinical discussion of the case This is, indeed, one of the most striking features about Stiles method of teaching He insists on an accurate knowledge of normal anatomy and works anatomy into the case all along

There may be those who believe that the teaching of anatomy can be carried to excess the excess being reached when physiology is excluded, but Stiles succeeds in avoiding this exclusion of physiology and shows a very careful discrimination of what points in anatomy are likely to be of value in the elucidation of the treatment of the case

The second case—tuberculosis of the kidney—which had been operated on three weeks previously and was now ready to leave hospital was demonstrated In this case Mr Wade had performed ureteral catheterization and had reported that the ureteral catheter had stopped at 20 cm Stiles immediately asked How far should it go ? and there was no answer Stiles said that their information was of no use to them unless they knew approximately at what anatomical level along the ureter its passage had been arrested

In the examination of the patient the first thing that the student was asked to do was to map out the kidney pelvis from the front   Stiles himself then demonstrated the best method of palpating the kidney, and the best method of eliciting kidney pain   He finished up by a rapid synopsis of the spread of genito urinary tuberculosis, and by showing specimens of tuberculous kidneys from the laboratory

The two students who were down stood for one and a quarter hours whilst all these points were being gone into, but so great is Sir Harold's grip of the students' needs, and so clear is his method of demonstrating cases, that the picture never for one moment in all this time became clouded by the discussion of unnecessary details, or insistence on unimportant points   One is impressed by the teacher's very great patience   The case is examined and discussed in a most leisurely manner   The students are not bullied or harried, and Stiles is apparently willing to wait an indefinite time for an answer   Every now and then he will break in on the student's description with some vigorous comments on the case, emphasizing his points in his enthusiastic way by repeated gesticulations

Fig 279 — An operation

with his hands   There is nothing strained about it, nothing sensational, and there is an entire absence of ' playing to the gallery '

A number of the students present were juniors who had not yet done any pathology, and Stiles told them, " I do not expect juniors to know any surgery, but I expect them to tell me what they see ', and strictly does he make them live up to this requirement

The third case was one which too many surgeons would scarcely have thought worth showing, in ancient case of osteomyelitis of the radius   In this case the blood supply of bone, medulla epiphyses, and metaphyses was gone into   The anastomosis round the joint was described , none of the students knew its technical term, and were left to find out for themselves what it was called   Haemogenic infections were then discussed, and the cause of the settling of organisms in bone ends   It is rather curious to hear the term new case used for involucrum (an ugly word), the old fashioned phrase being still retained at Edinburgh   Finally, of course, the surgical anatomy and the operation for exposure of the radius were discussed, and the structures enumerated which it is one's duty to avoid

Lastly a case of tuberculosis of the rib was shown together with the specimens of two ribs which had been removed from the case previously   Here the student in charge of the case was called down, and had to discuss the pathology of rib tuberculosis, and how it differs from tuberculosis of bone elsewhere , the surgical anatomy for the operation of exposure of a rib , and had to read an account of what was done in this particular case

This concluded the morning's clinic, which had lasted for three hours

Stiles has instituted a quarterly class examination which his clerks have to take This is conducted by Mr Wilkie and Mr Hartley   The questions are set on such cases of value as have been in the wards   The students are expected, in discussing the treatment of these cases, to give such methods as have been employed in the wards during their time , and no marks whatever are given for purely text-book answers, or even for discussion of alternative methods of what might have been done if the case had been a little different The object of the examination is to find out to what extent the students have observed and retained in their memories a case seen, and the surgical steps taken   A medal is given for this examination   The ideal aimed at in the clinic is one of intense observation on the part of the student, and a sound memory of the case that he has seen   To this end demonstrations of the same case before and after operation, more than once, is of great value   This may sound somewhat dull, but in practice it is surprising how interesting and how important the second demonstration can be

On Wednesday Stiles operated, first on a case of old-standing ulcer of the pylorus , doing a posterior gastro-enterostomy with fine thread   The operator used a mid-line epigastric incision, examined the ulcer, and removed the largest of the sub-pyloric glands , he then very rapidly tore through the gastrocolic ligament and exposed a large mass of glands on the deep surface of the pylorus   These were removed and immediately cut into, but showed no sign of epithelial metastases   It was interesting to note that these glands had given an erroneous impression to the fingers as to the size of the pyloric mass, the major part of which was due to these enlarged glands   He then proceeded to do a gastro-enterostomy   He tore through the gastrocolic ligament about its middle , the transverse mesocolon was then opened on his fingers in the usual manner and a selected piece of the jejunum drawn through   This method corresponds closely with that which Victor Pauchet has popularized but Stiles seems to have priority in this, as he has been doing it for many years   He points out that this is the anatomical method of doing a gastro-enterostomy, and that if one asked a student to expose the posterior surface of the stomach he would never dream of going through the mesocolon, but would certainly proceed to open the gastrocolic ligament   The point in favour of the latter opening is that one certainly does get a better view of the posterior surface of the stomach than one does by the ordinary method   In some difficult cases it is easier to make a better selection for the site of the anastomosis by this method, as one is bringing the jejunum up to the stomach rather than pulling the stomach down to the jejunum   The anastomosis is made in the ordinary two-layer manner   Stiles lays great stress on the closure of his abdominal incisions, and turns inwards the inner margin of the rectus sheath on both sides in the manner which he describes in the section on surgical anatomy in Cunningham's text-book

The next case was a large diffuse non-toxic adenoma of the thyroid of which the right lobe had been removed some years previously   The first step in this case was the ligature of both thyroid arteries first the superior and then the inferior, by de Quervain technique at the inner border of the carotid sheath   Owing to the large size of the gland this was by no means an easy step   but all through the anatomy of the operation was reviewed and kept constantly before the students   After these ligatures had been done a wedge resection was made   but in spite of the vessel ligatures there was a good deal of hæmorrhage, which was however fairly readily stopped by clips and hot saline packs   and ceased entirely when the cut edges were whipped together   Stiles as a rule uses intratracheal insufflation for his thyroid cases   For his tuberculous glands in the neck he uses chloroform as a routine   as also in his breast amputations   With chloroform he believes he has much

less hæmorrhage than with ether   The chloroform tradition is not nearly so strong now in Edinburgh as it has been in the past, and except for such special cases as these the anæsthetist uses what anæsthetic he prefers, usually open ether

The third case was nephrectomy for the tuberculous kidney demonstrated the previous day   For this his patient was flat on his face, and Stiles made a vertical posterior incision, removing the twelfth rib   He pointed out that this incision enables the operator to deal with the hilus most rapidly   the further he carries the incision round the flank laterally, the further he is going away from the vessel pedicle   The twelfth rib is removed as a routine, giving a clear exposure of the upper pole of the kidney, and thus rendering easy what is sometimes a difficult dissection   The anatomy of this approach was demonstrated to perfection

A reputation as a surgical anatomist is not always easy for a surgeon to live up to in practice , but there can be no question of Sir Harold s right to be called an applied anatomist of the very highest class   He not only knows just where structures are but is able to demonstrate them without blunt dissection   He goes straight to the spot with the knife-edge   His knowledge of the lie of the land in the neck is very unusually complete, as anyone who has seen him dissect tuberculous or malignant glands will admit   He uses a variety of incisions for these operations according to the character of the case   The J shaped incision is not commonly used, but great stress is laid on the mobilization of both anterior and posterior borders of the sternomastoid   A further point is that when disappointing results follow the radical operation for tuberculous glands, the commonest site for gland survival is the point of exit of the spinal accessory nerve at the posterior border of the sternomastoid   Stiles prefers to go through the mid-line of the abdomen, but he insists on an unusually careful closure of the incision   He uses interrupted sutures a great deal   He is one of those who never drain a collection of pus through the rectus sheath   He has a special plan for the closure of the flaps after radical amputation of the breast, cutting the inner flap at right angles for some three or four inches , it is remarkable how this manœuvre facilitates suture in a difficult case   His vertical incision in kidney cases has already been referred to , if it is necessary to resect the ureter, this is done through a separate incision low down in front

In the person of Sir Harold Stiles the true general surgeon reaches his zenith   During the war he became interested in orthopædics, and has worked to great advantage in that field , his long experience of children undoubtedly stood him in good stead here   He is not one of those on whom the abdominal walls have closed, and this is surely due to his exceptional knowledge of structural anatomy which causes him to revel in dissections of regions from which only too many are anxious to escape   His spare figure , the quick movements of his hands, almost Gallic in their nervousness , the slight and rather charming huskiness of his voice, his quizzical smile , and above all the intense enthusiasm which seems to burn in him, all go to make up a personality which one quickly recognizes as far from ordinary   Sir Harold appears to possess a further something that is a gift, which a man either has or (too often) has not—an ability to inspire, and above all to encourage, his juniors   When Sir Harold Stiles goes, there will not only be a mantle to descend, but there will be disciples for it to descend upon

DEFICIENCY OF THE MESENTERY OVER THE LOWER ILEUM

By GEORGE E ARMSTRONG, Montreal

By one of those strange coincidences that we are all familiar with, the two patients presenting the rare anomaly that I now report were in the Royal Victoria Hospital Montreal, at the same time   The anomaly consists in the absence of a mesentery for the terminal six or seven inches of the ileum (Figs 280, 281)

My own case was a man, age 33 years, sent up to me as a case of recurring appendicitis He gave a history of having had three attacks at intervals of a month or six weeks   The outstanding feature in his history was the severity of the pain during the attacks   He told us that during the last illness, from which he was just recovering, morphia failed to give relief, and that he had been kept under the influence of ether from 11 p m until 6 a m the following day   He referred all his trouble to the region of the appendix, and on admission the right lower quadrant was definitely tender   Seventy-two hours after
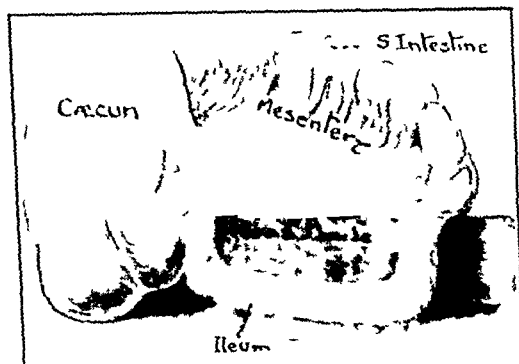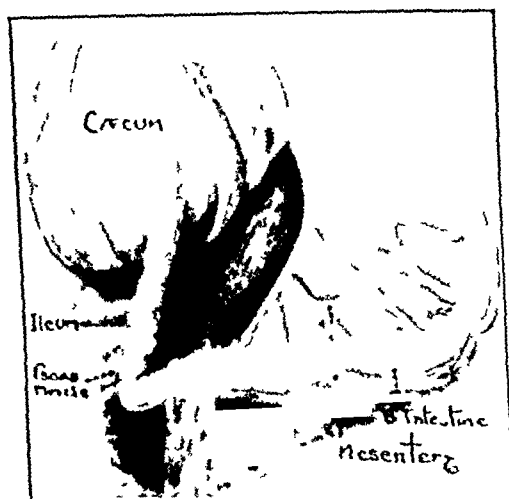
Figs 280, 281   Showing absence of mesentery at terminal part of ileum

admission I proceeded to uncover the region of the appendix   The condition observed on opening the abdomen was most unusual   The cæcum was very mobile and on pushing it and the ascending colon inwards the tissues outside the colon were found to be hæmorrhagic ecchymosed and at one spot the peritoneum was found lacerated   The appendix was curled up external to the ascending colon and retroperitoneal   It was congested   The area external to the colon looked almost exactly as if he had been kicked with a heavy boot   The terminal six inches of the ileum was subperitoneal   The deficiency in the mesentery began in the pelvis in front of the sacro-iliac synchondrosis, about an inch below the brim   From this point the ileum passed up over the external iliac vein and over the psoas muscle to its junction with the cæcum   It was very intimately adherent to the wall of the external iliac vein by means of normal tissue   There was no sign of inflammatory action   The appendix was removed and cæcum and ascending colon were sutured to the outer abdominal wall by three rows of sutures   So far there has not been any recurrence of symptoms

The other case was discovered at autopsy   The patient had been under the care of

one of my colleagues for a condition not associated with the anomaly On tracing the small gut downwards, it was found to be free from adhesions or exudate, and apparently ended suddenly at the brim of the pelvis over the right sacro-iliac joint On lifting up the cæcum, which was markedly dilated, it was found to be very mobile, with a definite mesocolon, and to be apparently disconnected from the ileum This was due to an anomalous condition of the last six inches of ileum The mesentery ended abruptly at the brim of the pelvis over the right sacro iliac joint, where the ileum became retroperitoneal and ran posteriorly across the iliopsoas muscle then turned upwards for nearly three inches, and lay in the groove between the iliopsoas and the quadratus lumborum It then reached the posterior surface of the cæcum, on which it ran downwards for about two inches to approximately its normal insertion at the ileocæcal valve In this manner, with the cæcum in its normal position it ran a course forming a loop with rather a sharp turn or kink at its point of junction with the posterior aspect of the cæcum This whole loop, when the cæcum was first lifted up, was completely flattened, and so not noticeable thus causing the appearance of the abrupt ending of the ileum at the pelvic brim Manipulation of the small gut and cæcum caused this loop to fill with gas and come into view It is probable that the anomaly caused a partial obstruction under certain favourable conditions
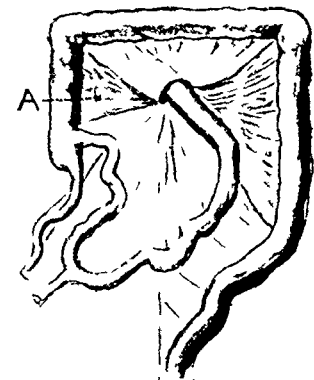
Fig 282 —Normal mesentery (A) Normal extent of fusion of mesocolon to posterior abdominal wall

It is interesting to note that since these cases were observed, Professor Whitnall (Anatomy) and Professor Simpsom (Histology and Embryology) have found two similar conditions in 50 bodies in the dissecting room of McGill University In these latter there was no clinical history, and no evidence that the anomaly had contributed to the death

The only similar cases that I have found recorded in medical literature were reported in May 1890, and published by W H Bennett, Surgeon to and Lecturer on Anatomy at St George's Hospital, and Rolleston,[1] Curator of the Museum They reported three examples of the anomaly, their attention being called to the condition by the fact that it
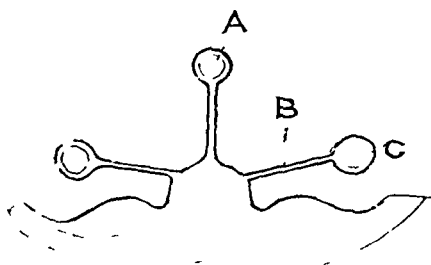
Fig 283 —Character of the mesocolon in the fœtus (A) Small intestine (B) Mesocolon (C) Ascending colon
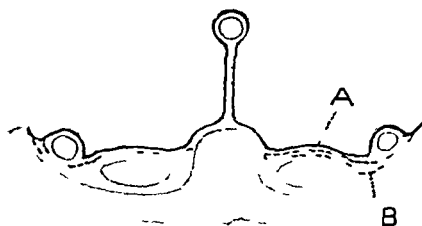
Fig 284 —Normal arrangement of peritoneum showing change which occur in the fœtal mesocolon (A) Ascending mesocolon fused to posterior abdominal wall (B) Peritoneal layers which are obliterated

was "associated with, and probably instrumental in producing a fatal twisting of the lower part of the ileum The cases that were observed in the Royal Victoria Hospital differed from those reported by Bennett and Rolleston in the length and mobility of the cæcum and ascending colon In their cases the cæcum had not descended into the right iliac fossa but lay over the right kidney Moreover, the cæcum was small and of the fœtal type

Normally, the ascending mesocolon of the fœtus is flattened against the posterior abdominal wall on the right side, and fuses with the parietal peritoneum over the area shown in Fig 282 Over this area the posterior layer of the fœtal mesocolon and the fœtal parietal peritoneum are obliterated, and the anterior layer of the fœtal mesocolon

becomes the parietal peritoneum of the adult   This is shown in *Figs* 283, 284   This fusion of the ascending mesocolon normally begins at the level of the right colic flexure and extends downwards   In the cases described, this fusion has apparently extended low enough to include the mesentery of the terminal part of the ileum as shown in *Fig* 285

A very possible cause of this extension of the area of fusion is the presence in the fœtal stage of a 'genito-mesenteric fold (*Fig* 286) which, by putting traction on the developing mesentery may cause a fusion of the ileum to the posterior abdominal wall   Douglas G Reid describes a genito mesenteric fold found in 11 of 20 fœtuses examined It passes from the inferior surface of the mesentery in the right half of the abdomen   forming an anteroposterior septum lying in the vertical plane, and incompletely dividing the portion of the abdominal cavity below the root of the mesentery into two compartments   The smaller of these is
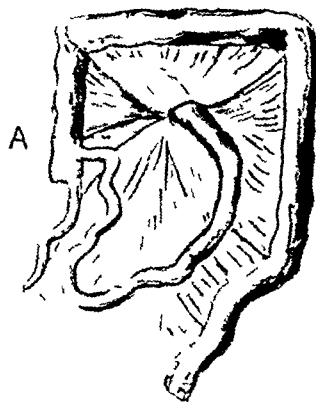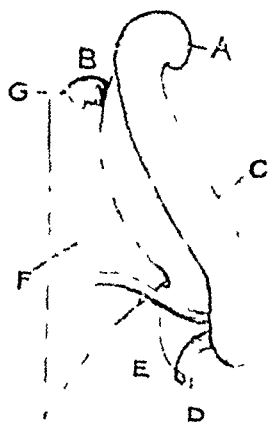
on the right side and contains the cæcum, the larger on the left contains the pelvic colon
The fold is triangular, and has two attached borders (superior and posterior) and one free (inferior)   The posterior border is attached to the posterior abdominal wall along the line of the right spermatic or ovarian vessels   The superior, or mesenteric, border is attached to the inferior surface of the mesentery, often to a considerable extent   This attachment to the mesentery is generally exactly along the line of the iliac branch of the ileocolic artery   The upper part of the fold may persist as the free edge of the duodenorenal ligament of Huschke   Its lower part may persist in the adult forming the medial boundary of the retrocolic fossa, passing from the ileum or appendix It is the commonest cause of a retrocolic position of the appendix   "The fold may also assist in producing adhesions of the duodenum cæcum, and ileum to the posterior abdominal wall   Adhesion in the adult, binding down the terminal part of the ileum, the cæcum the appendix, the mesentery, the meso-appendix, and even the 'bloodless fold of Treves, need not be the result of pathological changes, unless the natural

causes we have indicated for the adhesion can be excluded, although a genitomesenteric fold may not always be seen, even in the fœtus   (p 82)

REFERENCES

[1] BENNETT and ROLLESTON *Jour Anat and Physiol* XXX
[2] REID DOUGLAS G   "Studies of the Intestine and Peritoneum in the Human Fœtus," (6 figs), *Ibid*
1911 xlv 74

CLEFT PALATE.
THE ADVANTAGES OF A TWO-STAGE OPERATION

By THOMAS H KELLOCK, London

If one may judge by the number of cases of cleft palate that come for treatment for which previous unsuccessful or only partially successful operations have been performed, it is evident that the result of those operations must have been disappointing in many cases This is greatly to be deplored, because it is the first operation that offers the best prospect of success, when previous operations have been performed the tissue to be dealt with subsequently has been reduced in quantity by the paring of the edges, scarring has rendered them less elastic than normal, and previous experience of a somewhat painful ordeal has made the child intolerant of further interference

It is not my intention to discuss the age at which the operation should be done, I have seen no reason to change an opinion held for many years, that the proper time to operate for cleft palate is " the earliest age at which one can reasonably hope to obtain primary union by symmetrical suturing in the middle line " This age which varies a little with the degree of the cleft and the general development of the child, is generally between two and three years, if at or about that age one is fortunate enough to have to deal with a case that has not previously been damaged by unsuccessful operation, success ought to be more common than failure, and the object of this paper is to advocate a method of operating which in my hands has given much better results than I was able to obtain before adopting it

In cases where the cleft involves the soft and the whole or part of the hard palates, failure after operation may be total or partial In the case of total failure the cause is often a constitutional one, the general condition of the child preventing primary union, and this is often the result of a lengthy and severe operation In the case of partial failure—which is the more common—the cause I think is to be looked for locally The spot at which failure generally occurs is at the junction of the hard and soft palates At this spot the palate is thinner than elsewhere, and the soft palate, covered with mucous membrane above and below, has to be joined to the mucoperiosteal flap that has been raised from the hard palate and is covered with mucous membrane on its lower aspect only The most potent cause of failure at this spot is, I think, ischæmia of the parts, which is brought about by the lateral incisions that are made in order to bring the two halves of the palate together In the making of these incisions the posterior palatine artery or several of its principal branches must necessarily be divided, and so temporarily the central part of the palate is deprived of a good deal of its blood-supply and is therefore not in a good condition to unite by first intention, from the natural colour of the parts this effect of the incisions may not be noticeable during the operation, and the somewhat ischæmic edges may be still further damaged by the insertion of sutures It is chiefly to obviate this cause of failure that the operation has been divided into two stages with the object of ensuring good circulation in the lateral portions of the soft palate before they are sutured together

Before proceeding to operation there are a few details in the management of the patient, attention to which goes a long way in securing success It goes without saying that the child s general state of health should be at any rate fairly good in such an operation as this it is hopeless to expect a satisfactory result unless the power of healing is good, and this can only be obtained by a healthy condition of the patient In addition, the child should be happy, success is hardly to be expected if he is miserable and discontented after the

operation   During a week or so of observation previous to operation the child should be fed and treated exactly as he will be afterwards, so that the operation may make as little difference is possible in his daily life   As regards feeding, I have relaxed very materially the rigid rules formerly laid down, and have allowed quite a liberal diet both before and after the operation   When the latter has been performed the child will continually be swallowing saliva and mucus and there can be no harm in his swallowing some food as well   Children at this age often have very good appetites, and cutting down their usual liberal diet makes them unhappy and miserable , allowed to feed themselves with a spoon they may with safety take as much soft or finely minced food as they want   One may relax too, the old methods as regards the bowels , if they are acting naturally nothing at all need be done in the way of aperients or enemata , if this is not the case and constipation is present, during the week previous to the operation mild doses of aperient should be given regularly   and continued after the operation , for it is the onset of the need of an aperient that harms the palate and when once this is obvious the damage has been done and cannot be remedied

The two stage operation is carried out as follows in a case where the cleft involves the soft and the whole or part of the hard palates   At the first operation mucoperiosteal flaps are raised as usual from the hard palate through the small incisions A A (*Fig* 287), and the attachment of the soft palate to the hard is divided   These lateral incisions A A can
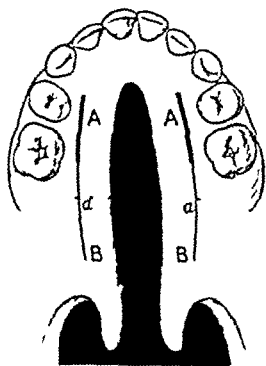
The dotted line represents the position of the posterior edge of the hard palate
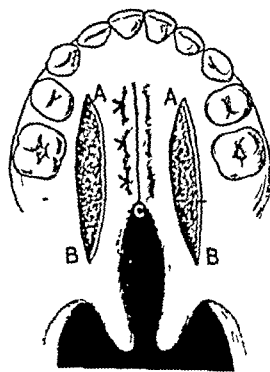
Fig 287   Fig 288

then be prolonged well back into the soft palate to B B, cutting through the mucoperiosteal flaps from A to *a* where the hard and soft palates joined, and through the whole thickness of the soft palate from *a* to B   The mucoperiosteal flaps from the hard palate can now be sutured in the middle line   and if they meet with a little to spare—as is generally the case   there is no need to freshen the edge, for the posterior (or upper) surface being raw when raised from the bone they can by the insertion of square stitches, be backed against each other and leave more or less of a frenum in the middle line

This completes the first stage of the operation   if the halves of the soft palate are slack there is a very great temptation to go on and complete the operation at the one sitting   but this should not be yielded to, and the parts should be left in the condition shown in *Fig* 288 the shaded parts A B representing the opening out of the original incisions   nothing has been done to the edges of the soft palate

This may have been a fairly severe operation but the hard-palate flaps generally unite easily   there being no muscle in them to draw them apart   and they are well supplied with blood from the front of the palatal arch   and the ultimate success of the operation does not materially depend on the child's general condition for the next day or two   As a rule they feel the effect of this part of the operation much less than one would expect

It is well to inspect the mouth about the third day after   and it will generally be found

that the lateral incisions A B have almost closed over again , these can then be gently re opened with some blunt pointed instrument

At the end of a week the circulation of blood in the two halves of the soft palate will have become well established from the ends, and the second part of the operation can be done   The sides of the soft palate will be found quite vascular and somewhat thickened, the latter a distinct advantage in the freshening and suturing of the edges

All that has to be done at the second operation is to freshen the edges of the soft palate and insert the sutures, and provided the knife and needle are quite sharp (an essential point) this can be done very quickly   An important point in freshening the edges is to be sure that it is properly done at the point C (*Fig* 288) where the hard and soft palates join, any doubling in of mucous membrane at this spot will surely prevent complete union, and it is often a help to re-open a small portion of the already sutured hard palate to ensure entire freshening at this spot   This very short operation—on which so much depends— upsets the child but little , he is already accustomed to the feeling that something has been done in his mouth, and it is generally possible to let patients be up and leading their ordinary lives on the following day

The advantages of this two-stage method are that at the first operation most of the work is done, and comparatively little harm can come even if the child be upset by it , and that the lateral incisions can be made very freely if necessary so as to render the subsequent approximation of the two halves of the soft palate quite easy   The interval between the operations allows the circulation in the sides of the soft palate to be well established from the ends, and this circulation is not interfered with at all at the second operation

The second operation is a simple and short one   there is a minimum of hæmorrhage , and it upsets the child little, if at all, and so gives the palate the best possible chance of complete union by first intention

INSTRUCTIVE MISTAKES

DILATED STOMACH TAPPED IN MISTAKE FOR PERITONEAL EFFUSION

F S, a married woman, age 42. Had had a short illness of about 6 months' duration, in which she had suffered from pain, loss of flesh, and slight jaundice

ON EXAMINATION.—She was thin and jaundiced—the stools were light-coloured but not devoid of pigment. There was no vomiting, appetite was lost, and she complained of a dull heavy pain in the epigastrium lasting many hours after food. The abdomen was thin and flaccid, and there was an indefinite resistance in the right hypochondrium

OPERATION Sept 6, 1920.—The abdomen was opened through the right rectus muscle. A tumour involving the head of the pancreas was felt, and the gall-bladder was moderately distended. The stomach and proximal part of the duodenum were normal. A diagnosis of malignant disease of the head of the pancreas with early involvement of the bile-duct seemed obvious, and a cholecystenterostomy was performed between the fundus of the gall bladder and the first part of the duodenum. The wound was closed without drainage

For two days after the operation the condition was satisfactory. On the third day she complained of pain, the pulse gradually rose, and the abdomen became uniformly distended. She had no vomiting, the bowels were opened slightly after an enema. The next day the distention and distress were more marked. The abdomen was globular, hard, tender, and dull to percussion. It was thought that the physical signs pointed to peritonitis with a low grade of infection, probably due to a leaking of bile from the anastomosis. Under an anæsthetic a medium sized trocar was thrust into the abdomen to the left and below the umbilicus. Several quarts of thin bilious fluid with a large proportion of mucus escaped, and then the fluid contained some small milk clots and some grape seeds, revealing the fact that the trocar had penetrated the stomach. The abdomen was opened by a vertical incision through the aperture of puncture, the stomach was drawn up into the wound, and the trocar opening closed by suture. The stomach appeared almost to fill the abdomen. A posterior gastro enterostomy was done, but the patient succumbed within a few hours. No autopsy was obtained

The two unusual features about this case were the absence of vomiting, and the dullness to percussion of the stomach. No doubt it was a paralytic acute dilatation of the stomach, and if a tube had been passed the nature of the condition would have been recognized, and possibly disaster would have been averted

FATAL HÆMORRHAGE DURING NEPHRECTOMY FOR A HYPERNEPHROMA

F H, a robust man, age 49, had had two attacks of painless hæmaturia during the month preceding admission. In the last of these several worm like clots had been passed. The cystoscope showed that the blood was oozing from the right ureter. The right kidney was just palpable through the stout abdominal wall

OPERATION July 7, 1921.—The right kidney was exposed through the usual incision, but owing to the thickness of the parietes it was found necessary to excise the 12th rib, in doing which the pleural cavity was opened. The kidney was then brought out of the wound. The organ was enlarged to about one third more than the natural size by a vascular growth occupying its upper pole. The pedicle was easily isolated, its three main

constituents were defined, the artery, vein, and ureter were separately clamped, and the kidney was removed   The duct and vessels were then tied in order from below upwards, there being no difficulty with the ureter or artery   On drawing up the large vein prepara tory to ligature, the forceps came away, the vein being torn through proximal to the clamp There was a furious hæmorrhage, which was only checked by gauze plugging   The most careful efforts at compression of the inferior vena cava, followed by removal of the gauze, enabled the stump of the renal vein to be found and secured, but by this time, in spite of transfusion, the patient was dead

It is easy to read the moral of this mistake   The vein was delicate, and the abdominal walls were thick   A ligature should have been passed round the pedicle as a whole, or round the artery and vein, or else the vein should have been ligatured first

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DIVISION OF THE PELVIC COLON IN A LEFT-SIDED SLIDING HERNIA DEATH A YEAR LATER FROM INTESTINAL OBSTRUCTION AFTER CLOSING OF COLOSTOMY

II H , a labouring man, had suffered from a large left-sided inguinal hernia for some years   He was fat, but otherwise healthy

OPERATION, Aug 10 1920 —An operation for the radical cure of the hernia was done On opening the sac, several coils of small gut were found and replaced in the abdomen The neck of the sac was obscured by a large mass of fat which closely enveloped the cord This was dissected free from the cord ligatured, and cut away   The stump of the fat mass was then seen to contain two cut pieces of colon   The ligature was cut, and an end to-end suture of the divided bowel undertaken   The wound was closed in the usual way

Three days later the patient's condition was that of intestinal obstruction with disten tion and vomiting, and a colostomy of the transverse colon was done to relieve this   For six months the colostomy was allowed to operate , but as the patient several times passed motions by the rectum, an attempt was made to close the colostomy by dividing the spur by means of an enterotome   This did not succeed, and although the colostomy opening became less prominent and bulging, there was no more passage through the rectum   He was re-admitted in August, 1921, and subjected to x-ray examination after an injection of barium mixture into the colon through the colostomy, and into the rectum through the anus   The result of this examination showed what appeared to be a continuous column of barium, and there was no evidence of stricture or kinking

OPERATION, Aug 30, 1921 —The colostomy wound was closed by separate layers of sutures, taking the gut first and then the parietes   On Sept 1 his condition was satis factory, but no flatus had been passed by the rectum   The next three days he gradually developed symptoms of obstruction, and on Sept 4 these were so unmistakable that the colon had to be opened at the colostomy , but, unfortunately, this was done too late, and the patient died the next day

The two mistakes in this case were   (1) The failure in the first place to recognize the nature of the fat mass in the neck of the sac, which was a sliding hernia containing a part of the pelvic colon   (2) In the second place it is clear that the x-ray evidence of continuity of the passage in the large intestine was unreliable , probably the colon was bent upon itself just at the site of stricture, so that the shadows of the gut proximal and distal to the lesion were superimposed but not really continuous   It would have saved the final disaster if the abdomen had been opened in the mid line and a short circuit operation performed excluding both colostomy and the site of the stricture

SHORT NOTES OF RARE OR OBSCURE CASES

FIBROMA OF THE MESENTERY.

By H. G. KYLL, Bristol

A tumour of the mesentery is a somewhat rare affection, and, the diagnosis being generally difficult to make, it may be of interest to record a recent case under my care at the Southmead Infirmary. I can find few records of similar conditions, though several instances of cysts, dermoids and sarcomata of the mesentery have been found

FIG. — ... growth. I, D. ... of portion of bowel involved by growth. T, Tumour growing ... I, Outside of portion cut. ... side of tumour shown in Fig. ...

A. D. Bevan gives an account of a large fibroma he removed from the mesentery. W. J. Greer having had such a case, searched the literature of the subject and was only able to find accounts of 32 others in the past 90 years. He gives a very instructive description of his own case, with details of all those previously recorded.

My patient, a male, age 40, had for about a year complained of abdominal pain and increasing constipation   In November, 1920, he noticed an increase in the size of his abdomen, and went to the General Hospital, where he was advised to come in for further examination , but feeling better and fearing the possibility of an operation he did not come

He was admitted to the Southmead Infirmary in February, 1921   I saw him there, and found a large tumour in the hypogastrium feeling and looking very much like a distended bladder   It varied very much in size and position from day to day , sometimes it was not to be felt, but when felt was always in the same position, and could be palpated bimanually with a finger in the rectum   He was seen by several surgeons, who were unable to make a certain diagnosis, although the possibility of its being a mesenteric tumour was suggested by one
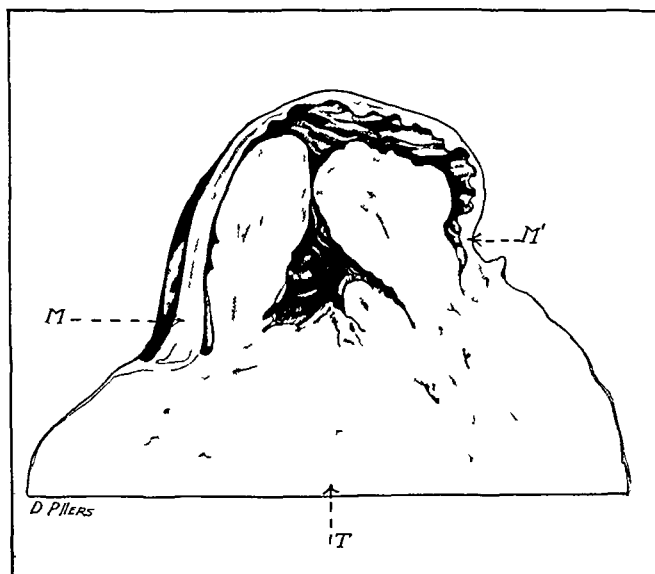
Fig 290 —Fibroma of the mesentery   M, M Muscular wall of gut   T Tumour projecting upwards as two polypoid masses into the lumen of the gut

OPERATION —On Feb 11, 1921, I opened the abdomen and found a large tumour growing in the mesentery of the ileum   The intestine was tightly stretched across and intimately connected with it , outgrowths of the tumour could be felt projecting into the lumen of the bowel   It was somewhat vascular in appearance, and suggested a sarcoma It was freely movable, and when displaced slipped right up into the upper abdomen

I resected about 6 inches of ileum and removed the tumour, which weighed 3 lb (Fig 289)   On section (Fig 290) it had just the appearance of a uterine fibroid Professor Walker Hall examined it, reporting it to be a simple fibroma, not sarcomatous The patient was much relieved by its removal, his abdominal pain disappeared, and the bowels now act regularly   Two months afterwards he had put on 12 lb in weight

The drawings of the tumour were made for me by Miss Pillers

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FIBROMA ARISING IN THE PALM OF THE HAND

By NORMAN HODGSON, Newcastle on Tyne

Tumours of any description in the palm of the hand are of rare occurrence. A fibroma in this situation is exceedingly uncommon, although from the nature of the structures one would expect that this would be an ideal situation for their growth. The following is a description of such a tumour.

The patient, a boy, age 7 years, presented himself complaining of the inconvenience caused by a tumour in the palm of his right hand. It was first noticed twelve months previously, and had gradually increased in size, with more rapid growth during the last three weeks. There was no complaint of pain, nor was it tender to the touch. The

Fig. 1.—The tumour in palm of hand
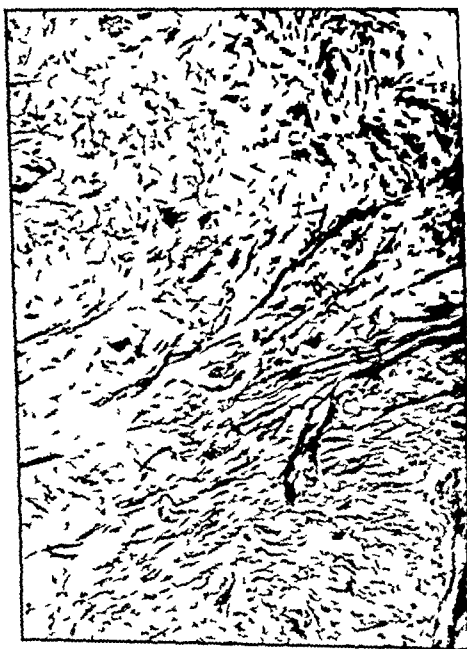
Fig. 292.—Micro section of same case

situation was as seen in the accompanying photograph (Fig. 291). The tumour was the size of a walnut, firm and elastic, not fixed to the skin or deep structures, nor were the tendons attached to it. X-ray examination showed that it had no connection with bone. The boy showed no other physical signs of disease.

The tumour was removed by dissection extending between the tendons of the ring and middle fingers; it was not in any way attached to them, and its removal was a simple matter.

On section to the naked eye the cut surface resembled cartilage in colour. Microscopically the report was " fibroma with areas of myxomatous degeneration " (Fig 292). The wound healed per primam, and the boy is reported to be perfectly well.

A CASE OF HEREDITARY POLYDACTYLISM
OCCURRING IN FOUR GENERATIONS AND MANY MEMBERS
OF THE SAME FAMILY

By E. MILES ATKINSON, London

CASES of polydactylism are not extremely uncommon, and the hereditary tendency of the deformity is well recognized   The interest of this case lies in the fact that it has been possible to trace the occurrence of the deformity back through four generations, and to many members of the family

GENEALOGICAL TABLE

M = Male
F = Female
o = Condition not present
\ = One additional digit on each hand and foot
† = One additional digit on each foot only
a = Patient with condition shown in Figs 293 294
b =   Figs 295 296
c =   Figs 297 298 299
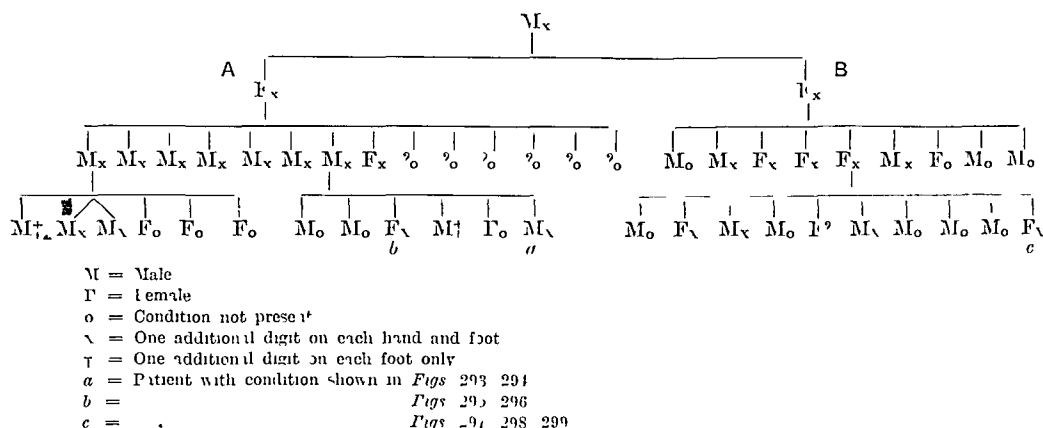
An analysis of the appended genealogical table shows that 48 persons, distributed through four generations, have been traced   Of these, 26, or more than half, have exhibited a condition of polydactylism, 17 being males and 9 females   Males have, therefore, in general, been affected twice as often as females

But this sex incidence in favour of the males does not hold for both branches of the family   The descendants of one of the two daughters in the second generation—the branch marked A—show a preponderance of polydactylism in the males to the same condition in the females of 11 to 2 , while branch B shows a reversed, though much less marked, state of affairs, the condition occurring in 5 females and in only 4 males   In the last generation of this branch, moreover, one female marked ? was a stillborn child, and it is not known if the condition was present or not   Thus, on the one side the deformity has been transmitted from a male, through a female, chiefly to males ; on the other in the same way chiefly to females   There seems to be no marked Mendelian feature, nor any common factor, in the nature of its transmission

As regards the actual deformity present, with two exceptions the same condition occurred in every case—a supernumerary digit, varying in the completeness of its development, upon the posterior border of each hand and foot   The two exceptions are two males, both in branch A, but sons of different fathers, in whom supernumerary digits were present on the feet only   This would seem to indicate that the tendency to inherit the condition is becoming less marked, at any rate among the male members of this branch of the family, so many of whom have been affected

Anatomical Features of the Deformity—Although in this family no case has occurred in which there was more than one extra digit on any one limb, cases of as many as eight digits on the hand have been reported,[1] and one case with nine toes has occurred

in America Two cases of a curious condition of bifurcated hand, in which eight fingers were present and no thumbs have also been recorded [2]

According to Tubby,[3] in the usual state of affairs, in which there is only one additional digit the commonest one to be double is the fifth, the next in order of frequency

Fig 293
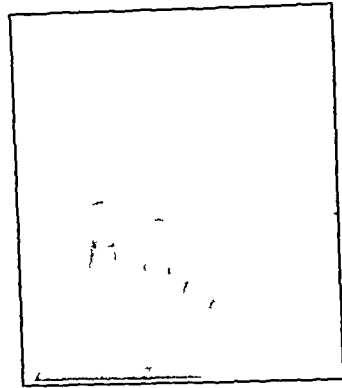
Fig 294

is the first and rarely any other The supernumerary digits are said by the same authority to be usually abnormal and ill developed, and devoid of a metacarpal

That these last statements are by no means always correct can be seen from the accompanying skiagrams of some of the present cases In Figs 293 and 295 the additional fingers are very poorly developed and are functionally useless In Figs 298 and 299 the degree of development is much greater and, moreover the fingers in this child could be flexed and extended almost to the same amount as the normal fingers though abduction and adduction were very limited while in Figs 294 296 and 297 the development and function of the additional toes were such that it was very difficult to say clinically which of the two outer toes was the real fifth and which the supernumerary digit In fact in the right foot of Fig 296 it was eventually decided that the outermost was the supernumerary toe the correct decision being only come to after seeing the skiagram The above remarks hold true for one or two other older members of the family who were seen but who were not skiagraphed
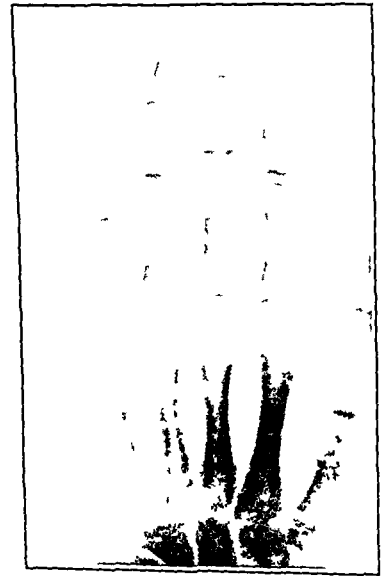
Again as regards the usual absence of the meta-carpal it will be seen that the whole or part of a metacarpal bone is present in every skiagram with the exception of the first Even in this case although when the skiagram was taken there were only two ossific

Fig 295

centres present in the rudimentary digit it is possible that had the finger been allowed to remain, a similar condition to that seen in Fig 295 would have appeared, in which there are definitely four bones present one being a rudimentary metacarpal So that it would seem that at any rate the head if not the whole, of the metacarpal is usually present and with this the additional digit articulates If the head only is present, it may occur as a separate piece of bone as in Fig 296 or the metacarpal bone may serve for two digits the distal extremity being bifid, as in Fig 297

Pathology —The occasional occurrence of additional digits on the hands and feet has formed one of the arguments brought forward by some comparative anatomists against the theory that the pentadactyle manus and pes is the primitive condition in mammals They would regard these additional digits as evidence of the previous existence of a

L   R

Fig 296

pre-pollex or pre-hallux and of a post-minimus   The work of Howes and Hill on the Dorking Fowl[4] seems to settle the matter conclusively   As a result of their investigations, they conclude that accessory digits are due to fission, and that any increase or decrease of digits from the number five as a normal phenomenon is to be regarded as a specialization

L   R

Fig 297

A consideration of the x-ray appearances tends to confirm this conclusion, that the presence of accessory digits is due to a process of dichotomy which, had it extended further would have produced an accessory limb, as in the case of J B dos Santos (the Human Tripod),[9] or some form of external teratoma   The appearance of the metacarpal

bones in *Figs* 296, 297, and 298, with their bifid distal extremities, can be more reasonably explained on this theory than on any other   Wood Jones[6] sums up the position in favour of the theory of dichotomy very neatly by pointing out that the fact of babies being occasionally born with two heads " affords no safe ground for believing that our single head has been derived from a primitive condition of polycephaly "
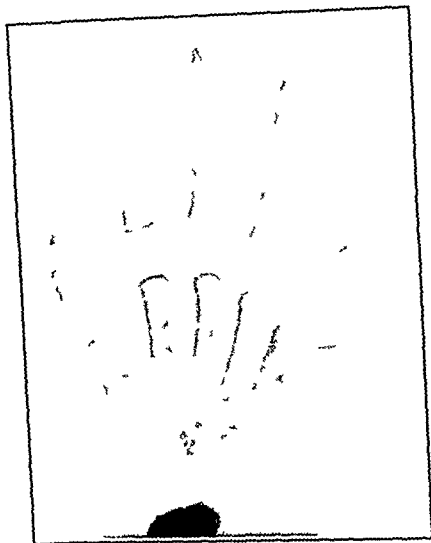
FIG 298
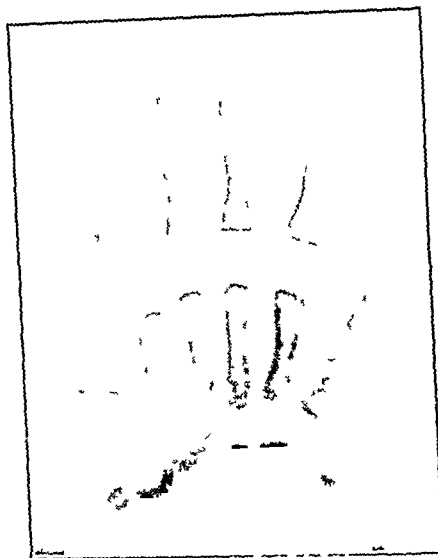
FIG 299

Treatment—The treatment of the condition is amputation of the supernumerary digit, and care must be taken to ensure that it is really the supernumerary digit that is being removed   If the true digit is amputated by mistake and the accessory one left, the latter will become distorted and displaced, unless it is unusually well-developed and has a complete metacarpal or metatarsal bone

In these cases, where accessory fingers were present, they were amputated as being unsightly and practically or absolutely useless   Accessory toes, however, were left, as those patients who also had them stated that they caused no inconvenience beyond the fact that boots a size too large in length had to be worn in order to allow for the increased breadth of the foot

My thanks are due to Miss Moody Stewart for much trouble taken in collecting the children and their family histories and to Mr R C Elmslie for permission to publish the case, and for his help and advice

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A CASE OF DOUBLE CONGENITAL DIAPHRAGMATIC HERNIA

By M FITZMAURICE KELLY, BRIGHTON

A S , age 35, was admitted to No 30 General Hospital, Calais, Aug 9, 1917, with abdominal pain and vomiting   The onset dated from Aug 6 , since then vomiting had been constant, and nothing had been passed per rectum   The temperature had risen to 101° on the evening of Aug 8

There was a history of two previous attacks of abdominal pain and vomiting since the beginning of the war   these had yielded to treatment   When seen, the patient looked very ill, with an anxious expression   The abdomen was very greatly distended, tympanitic in front and dull in the flanks   Liver dullness abolished   The temperature was 99°, pulse rapid and weak, respiration hurried and thoracic in character

Operation —Exploratory laparotomy through a right paramedian incision   The coils of small intestine were enormously distended, and at first the cæcum could not be found   The small intestine was tapped in two places with a trocar and cannula   The cæcum was then found close to the middle line, immediately below the liver, and the ascending colon was found passing through an aperture in the front of the diaphragm behind the seventh right costal cartilage, close to the ensiform cartilage   The gut was strangulated at this point

The constriction was relieved by dividing the attachment of the diaphragm to the eighth costal cartilage   adhesions within the sac in the thorax were then separated from below and the hernia reduced without great difficulty   The patient's condition precluded any attempt to close the neck of the sac , the latter was stuffed with gauze as a temporary measure, and a Paul's tube tied in the cæcum   The patient continued very ill throughout the next day, and died in the evening of August 10, thirty hours after the operation

Post-mortem —The small intestine was greatly distended , but there was no peritonitis   The bowel reduced from the hernia was congested, and was found to consist of large intestine only   The sac, about the size of a fœtal head, lay to the right of the pericardium and in front of the lung and pleura , it was lined with a protrusion of the peritoneum, and did not communicate with the pericardium or pleura

On the left side was an exactly similar hernia, lying in front of pericardium and pleura, and containing another loop of large intestine   The neck of the sac, being undamaged, was studied on this side   The attachment of the diaphragm to the seventh costal cartilage was absent, and the neck of the sac was thus bounded in front by the seventh costal cartilage, on the inner side by the attachment of the diaphragm to the ensiform cartilage, and on the outer side by its origin from the eighth costal cartilage , behind, an arch of muscular fibres, about three quarters of an inch in breadth separated it from the central tendon   The position and relations of the necks of the sacs are shown in the accompanying diagram (*Fig* 300)

From the sac on the left side the large intestine descended vertically in front of the stomach to the brim of the pelvis, where it passed straight into the rectum   The arrangement of the large intestine, and its relation to the sacs and to the stomach, are indicated in *Fig* 301

The liver was remarkable, the right lobe being divided from the left by a deep median groove and the two lobes being united by a relatively narrow isthmus   This division was due partly to the presence of the necks of the sacs close together in the middle line and partly to the looping up of the round ligament of the liver by the herniated colon

The arrangements of the peritoneum were of great interest   The hernia had a sac derived from the peritoneum, though for the most part obliterated by adhesions   The mesenteries of the colon and colic vessels passed upwards in front of the stomach   The descending colon, passing down in front of the stomach, was attached to it by a short mesentery   below the stomach the mesenteric attachment descended vertically to the brim of the pelvis   The great omentum was undeveloped

The case recorded above presents several features of interest The condition was I think, clearly congenital—witness the arrangement of the colon, which could not be divided into its usual parts, but was almost entirely in the herniæ, and of its peritoneal connections, which showed clearly that it had passed through the hernial apertures before the obliteration of its primitive mesentery The form of the liver, too, points distinctly to a congenital origin It is noteworthy that, in spite of this, the patient had reached the age of 35 without severe disability, and had been nearly three years on active service, mostly in the front line

The sacs are remarkable—indeed, as far as my search through the literature goes, are unique—in two respects In the first place, I cannot find that any case of double diaphragmatic hernia has been recorded hitherto, and secondly, among the many congenital herniæ which have been published, in no case has the sac been in the same position as that now described They seem, almost without exception, to have been on the left side in relation to the œsophageal opening, and to have contained the stomach with or without other abdominal contents That condition is, indeed, easily explained on embryological grounds , but I have not been able to find anything in published work on
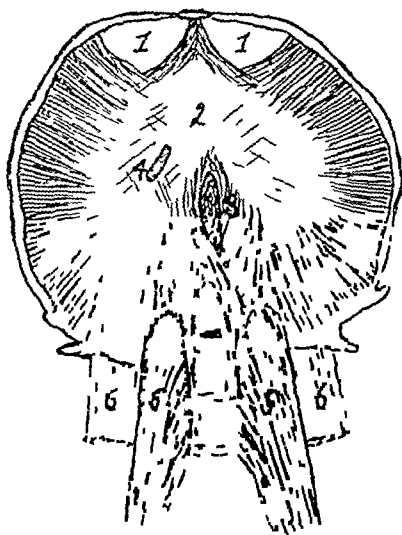
FIG 300 —1 Neck of sac 2, Central tendon
3 Œsophageal opening   4, Opening for vena cava
inferior 5, Psoi   6 Quadratus lumborum
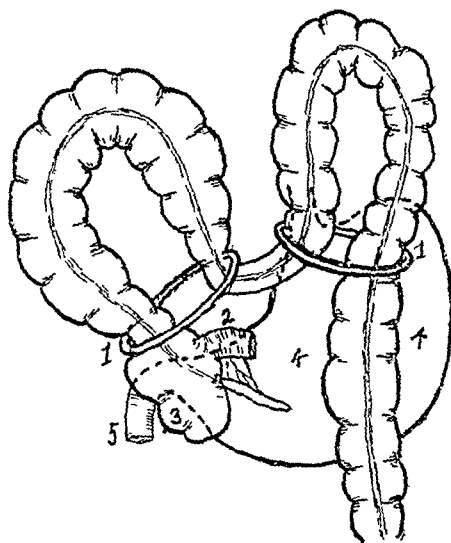
FIG 301 —1, Neck of sac   2 Small intestine.
3 Cæcum 4, Stomach   5 Duodenum

the development of the diaphragm to explain the presence of the openings found in this case   And Sir Arthur Keith, to whom I naturally turned in this difficulty, agreed that no explanation was at present forthcoming   At the same time, it is an anatomical fact that a distinct gap is present between the sternal and costal attachments of the diaphragm , and it is possible that further research into its development will throw some light on the genesis of the present case

As regards treatment, the case now reported was, unfortunately, seen too late to give much chance of recovery, and the question of radical treatment did not arise at operation. But I was impressed at the time with the difficulty—almost the impossibility—of dealing with the sac and the opening from below , and had further operation been feasible, I am convinced that the thoraco abdominal route would have held out the best prospects of success

I must express my gratitude to Professor T R Elliott for his assistance in recovering the notes of this case from the records

A CASE OF PERSISTENT VITELLINE DUCT ATTACHED TO THE VERMIFORM APPENDIX

By P T CRYMBLE, BELFAST

THE persistence of the full length of the embryonic segment of the vitelline duct, patent and opening at the umbilicus, has been frequently described   Numerous variations of its intestinal attachment have also been recorded, both when it was complete, and when it persisted only as Meckel's diverticulum , so that according to Kelly,* " the attachment of Meckel's diverticulum to the bowel has been found at all parts between the duodenum and the colon "   This case is one in which a persistent vitelline duct was attached to the vermiform appendix, and, as far as has been possible to discover, it is unique in this respect

A male child, five months old, was brought to the Belfast Hospital for Sick Children for treatment of a projecting mass at the umbilicus   The mother stated that after the cord had separated, a small red projection persisted at the umbilicus, and that this had gradually grown larger in the ensuing months   No fluid or fæcal matter had ever been discharged from the umbilicus, but the surface of the mass had always been somewhat moist   On examination, it was seen that, projecting perpendicularly from the umbilicus, there was a dull-red conical mass about an inch and a quarter in length and having a diameter of about the adult little finger   Its surface was moist and had all the appearances of mucous membrane , and at the margin of the umbilicus this appeared to be continuous with the skin   At the apex of the projection there was an aperture through which a probe could be passed freely into the abdomen

A skin incision was made round the umbilicus, and carried upwards and downwards for a short distance in the middle line   It was then deepened through the abdominal wall until the peritoneal cavity was opened, when the nature of the projection was at once demonstrated   It was the prolapsed part of a persistent vitelline duct, the proximal extremity of which was attached to the vermiform appendix (*Figs* 302, 303)   The cæcum, which lay in the middle line above the umbilicus, was observed to be of the infantile type   It was freely movable, and there was a mesentery common to it and the ascending colon   The appendix was divided at its base and the vitelline duct thus removed   The child made an uninterrupted recovery

The vitelline duct arose from about midway on the length of the appendix and from the surface opposite the attachment of its mesenteriole   It is a little thicker than the appendix It passes to the umbilicus almost at once, and the greater part of it is prolapsed through that opening   Its total length, when the prolapse was reduced, is 3¼ in   Superficial examination shows
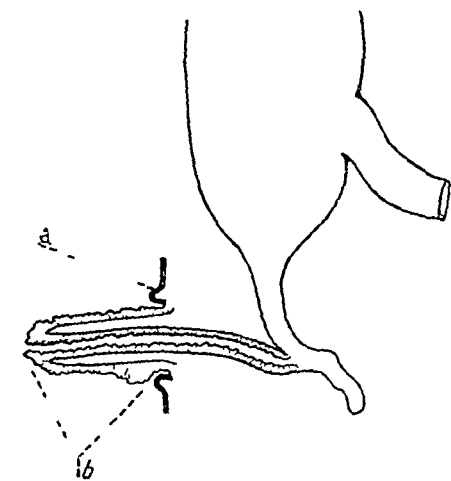
FIG 302 —Diagram of the relations and connections of the vitelline duct in the present case *a* Skin at umbilicus *b* Prolapsed part of duct

that the peritoneal and muscular coverings of the duct are continuous with those of the appendix, and that, passing along its proximal part, there is an artery derived from the main stem of the artery to the appendix, and in regard to the nomenclature of which speculation will exist   It sinks beneath the muscular coat about three quarters of an inch from the appendix

A transverse section of the duct (*Fig* 304) shows that in structure it resembles the appendix most of all the parts of the bowel   The glands are more numerous and more

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* KELLY, *The Vermiform Appendix* p 595   It is probable that many authorities would doubt the classification of the duodenal and even the colic diverticula

convoluted, and the lymphoid tissue is not so abundant as in the adult appendix, but there is the same increase of the submucous layer The muscular layer is in two uniform coats The artery, with an accompanying vein, is seen deep to the muscles

The chief interests of this specimen lie in the peculiar developmental relations implied by its basal attachment, and in the manner in which its peripheral part is related to the tissues of the umbilicus It seems possible to explain the attachment of the duct to the appendix only on the view that the cæcal diverticulum of the gut occurred at the apex of the primitive intestinal loop, and that the duct remained attached close to the apex of the diverticulum

A section through the umbilicus (*Fig 305*) shows very clearly the sharp demarcation between the skin and the mucous membrane of the duct The prolapsed mucous membrane is seen to be denuded of its epithelium, and to

FIG 303 —The specimen as removed   (*Natural size*)
a Umbilicus, *b* Base of appendix, *c*, Aperture at apex

have over its surface a number of small hæmorrhages and what appear to be small necrotic areas The glands of the prolapsed part also seem to be degenerating At the actual junction of the skin and the mucous membrane, the blood-supply of the two parts is from a common source—that is, the mucous membrane of the duct might derive its blood-supply from the blood-vessels of the umbilical wall It has already been pointed out (Stiles) that this factor might account

Fig 304 —Transverse section of the vitelline duct   (× 10)
a Artery

FIG 305 —Section through the junction of skin and mucous membrane at umbilicus *a* Junction of skin and mucous membrane

for the persistence of mucous grafts of the vitelline duct or the urachus at the umbilicus, even after there has been a total atrophy of the intra embryonic segments of those structures

The author desires to thank Professor Walmsley for the histological investigation of the specimen and for assistance in the preparation of the paper

A CASE OF TRIGEMINAL NEURALGIA IN A BOY, AGE 10 YEARS, TREATED BY INTRACRANIAL DIVISION OF THE SECOND AND THIRD DIVISIONS OF THE NERVE

By J HAMILTON BARCLAY, Newcastle on Tyne

This case justifies its publication on account of the extreme youth of the patient

History—A K , age 11 years, was admitted to the Hospital for Sick Children, Newcastle-on-Tyne, Oct 8, 1918, with severe attacks of pain and twitching of the facial muscles on the right side of the face

The boy had received a blow on the right side of the face about two and a half years previously   The symptoms came on about a year after the accident, and occurred on an average every hour for about two days per week   X-ray examination revealed nothing abnormal , the teeth had previously been attended to, and several had been removed   He was treated by sedatives and general hygienic measures, and was much improved when he left hospital on Oct 26

The pain returned and became very severe, and he was re-admitted on Dec 17

The following are the notes of his condition at that time   " He now suffers from spasmodic attacks of severe pain , talking excites an attack, radiating over the right side of the face   There is an erythematous rash on the right side   Percussion of the inferior dental, superior maxillary (?), supra trochlear, or supra-orbital nerves does not excite a spasm   He averages three attacks every two hours   He is a healthy looking child, and has had no serious illness before No atrophy or paralysis of the facial muscles "

On Dec 21, 1918, he was operated on by one of my predecessors   Under chloroform anæsthesia a trocar and cannula was inserted below the right zygoma, and absolute alcohol injected into the second division   Œdema of both lids of the right eye was noticed, and hæmatomata developed in these eyelids while recovering from the anæsthetic, during which time there was twitching of the facial muscles The hæmatomata gradually disappeared and the [attacks became fewer and less severe, completely disappearing in three weeks   Discharge, Jan 17, 1919

Fig 306 —Showing operation scars in right temporal and infra orbital regions

Two months later, attacks returned, and the boy was re-admitted for the third time,   The day following he was operated on A transverse incision was made below the right orbit, the terminal branches of the infra orbital nerve were divided, and alcohol injected into the canal   The pain was relieved and he went home May 13

After six months freedom from pain, the spasms returned with a severity which necessitated his admission to hospital for the fourth time, on Feb 4, 1920, under the care of the writer

The Condition at that time was as follows   He was having excruciating 'epileptiform attacks of pain on the right side of the face, accompanied by twitching of the right facial muscles every two or three minutes (typical 'tic douloureux')   During a preliminary

examination, lasting about ten minutes, he had four severe spasmodic attacks of pain, these chiefly involved the second division of the fifth cranial nerve (mostly infra-orbital branch), but also to a less extent the third division of the nerve (mostly inferior dental branch) The first or ophthalmic division was not affected During the attacks the boy screwed his face up, and pushed his hand hard on to his face His mother stated that when the pain came on at first he moaned and groaned, but later it became so severe that he screamed out and frequently disturbed the neighbours During the two days he was in hospital before the operation he had no sleep Ordinary sedatives were useless During the spasms there was flushing of the right side of the face, and also some increased lachrymation and salivation Eating or speaking, or any excitement, provoked attacks Pressure on the angle between the right ala nasi and the cheek also brought on a spasm— the mother stated that he had to be very careful in washing his face, and that he would not allow her to do it Sitting in front of a fire also excited the spasms

There was no apparent local cause for the trouble X-ray examination was negative, and there was nothing abnormal in the eyes, nose, or ears Every effort was made to exclude the presence of a cerebral tumour The general condition was very poor owing to the pain and loss of sleep and food

As it was obvious the boy could not go on as he was, a more radical operation was decided upon

Operation, Feb 6, 1920 —Under general anæsthesia (A C E and ether) a semi-circular incision, convex upwards, was made, extending from a point immediately above and in front of the right pinna posteriorly to a point a short distance above and behind the external angular process of the right frontal bone The convexity was about $1\frac{1}{2}$ to 2 in above the base of the flap All the structures were divided down to the bone, and the soft parts peeled down towards the zygoma, which was not interfered with A $\frac{1}{2}$-in trephine opening was then made above the middle of the zygoma, and this was enlarged by rongeur forceps, especially downwards towards the infratemporal crest, till the opening was approximately $1\frac{1}{2}$ in in diameter Owing to the age of the patient and his poor general condition, it was not thought advisable to prolong the operation by turning down an osteoplastic flap The dura mater was then separated from the floor of the middle fossa (partly by blunt-pointed, curved scissors and partly by gauze dissection), and kept out of the way by a flat retractor The second division of the trigeminal nerve was soon distinctly seen running as a whitish cord from the dura mater to the foramen rotundum (it was anticipated that the third division of the nerve would have been encountered first) The second division was not divided at this stage The trunk of the middle meningeal artery was then seen emerging from the foramen spinosum, and kept constantly in view without dividing it Immediately anterior and internal to this, the third division of the nerve now came into view after further separating the dura Considerable difficulty was met with in separating the dura from the edges of the foramen ovale—this difficulty was increased by an unduly large prominence on the floor of the middle fossa immediately external to the opening In order to effect the separation more easily and secure more room, the second division was seized with forceps, and a third to a half inch of the trunk excised The dura was well separated from the margins of the foramen ovale, and the third division cut across—there was not sufficient of the trunk between its origin from the Gasserian ganglion and the foramen ovale to excise a portion A probe, bent towards the point at a right angle, was pushed into the foramen ovale and foramen rotundum to make sure that these openings were empty, and their margins could now be seen all round A fair amount of hæmorrhage occurred on dividing the third division, presumably from the small, or accessory, meningeal artery coming up through the foramen ovale A piece of temporal fascia was implanted over each opening, and the brain was allowed to expand The wound was sutured—the temporal fascia and muscle with catgut, and the skin with silkworm gut A small drainage tube was left in the posterior angle of the incision for twenty-four hours The operation lasted about an hour and a half a large part of this time was spent in separating the dura from the margin of the foramen ovale The patient stood the operation well, during which there was very little

hæmorrhage , there was remarkably little on separating the dura from the middle fossa, the only bleeding of any moment was on cutting across the third division, but this was soon controlled by gauze pressure and allowing the brain to expand by removal of the retractor   The middle meningeal artery was not interfered with   There was no escape of cerebrospinal fluid, except a slight amount on cutting the third division

Condition after Operation —The boy made a good recovery, and went home on March 28   It was noticed after the operation that the pupil was contracted and the palpebral fissure narrowed on the right side (*Fig* 306)   This was probably due to some injury to the cavernous plexus of the sympathetic, fibres from which supply Muller's muscle in the eyelids and the dilator pupillæ in the iris   It was also noted that the boy could not wrinkle his forehead on the right side, due to the branch from the facial nerve to the corrugator supercilii muscle being divided in the anterior part of the scalp wound

The operation immediately produced the desired results—the pains ceased, and there was anæsthesia over the cutaneous and mucous surfaces supplied by the second and third divisions of the trigeminal nerve, including ordinary sensation of the right half of the tongue in its anterior portion   Taste was little, if at all, affected, the taste fibres of the third division joining the lingual nerve outside the skull, via the chorda tympani nerve   There was also paralysis of the muscles supplied by the motor portion of the third division, i e , the muscles of mastication   This was only slightly noticeable, the muscles on the other side apparently being able to carry on the function satisfactorily   When the boy opened his mouth there was slight deviation of the mandible towards the right side   He chewed with the left side of the jaw, and food was apt to collect on the right side   There was also a tendency for saliva to dribble out of the right angle of the mouth   There was no facial paralysis other than that of the right corrugator supercilii above mentioned

Present Condition, July, 1921 —He is now in the best of health (17 months after operation)   He has put on weight, is sleeping and eating well, and has had no recurrence whatever of the pain   There are no signs of the trouble spreading to the ophthalmic division of the nerve

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A CASE OF ABDOMINOTHORACIC TETANUS (MARIE)

By S T IRWIN, Belfast

The patient was a farmer, age 50, whom I saw in consultation on March 2, 1920

History —The man was seized with a sudden attack of pain in the left side of the abdomen on February 28   He was put to bed and poulticed, and given a dose of castor oil   Next day, as the pain had not abated, he was seen by a doctor, who found the temperature 101°, pulse normal, and some rigidity of the upper abdomen   On the third day there was no alteration in the man's condition, and a surgeon was called in   The latter thought there might be an abdominal lesion and advised an exploratory laparotomy   The man was therefore removed to a cottage hospital, where the abdomen was opened through an upper left rectus incision on Monday, March 1   An extensive search was made of the whole abdominal cavity without finding any lesion sufficient to account for the symptoms   On recovering from the anæsthetic the symptoms began again, and the pain was so severe that repeated hypodermic injections of morphia were required   Even these did not relieve the severity of the spasms

Next day I was asked to see the patient, and examined him the same evening, twenty four hours after the laparotomy   In addition to the history already given, I learnt that twenty years ago he had suffered from bone disease of the left thigh and knee, and that the latter was stiff   There was a small sinus from which a discharge now and then escaped, the last time being about a month previously   I also learnt that he had had an attack of pain in the *right* side of the abdomen a fortnight ago, which had disappeared with poulticing and a dose of castor oil   As regards the present affection, he had been vomiting

during the whole twenty four hours succeeding the operation , he had passed no flatus per rectum, but his bowels had acted well after the aperient which he had had on the first day of the attack   He said the pain was continuous, but at times he got such a severe 'cramp' that it made him cry out

Examination —The man was healthy-looking and well coloured   Every few minutes he vomited a small quantity of bile stained fluid   Temperature 99 2° , pulse 68 , respirations 24   Tongue moist and moderately clean , the heart was normal   Chest moved normally, with the exception of the lower part of the left side, where there was obvious rigidity, replaced now and then by severe contractions   There was no dullness, and no friction sounds or crepitations were to be heard anywhere   The abdomen was generally distended, but not fixed   Respiratory movements were present, but were better marked on the right side   Both sides of the hypogastrium were soft   There was a healthy-looking wound through the left rectus, closed by sutures   There was no localized swelling, and no localized tenderness could be elicited

The *left costal margin* demands special description   The patient centred his pain around the tip of the 10th costal cartilage   On pressure a rough crepitus could be felt, and on auscultation could be heard, over this cartilage   The tip of the cartilage was loose and could be rubbed on the rib above   At times this seemed to produce severe pain and spasm of the neighbouring muscles—left rectus, oblique muscles, and apparently, lower intercostals

The *left knee* was ankylosed   There was a depressed discharging sinus just above the left knee-cap   The discharge had begun about four weeks previously   Rectal examination was negative   Urine 1022 , acid , contained a trace of albumin , no sugar , loaded with urates

Differential Diagnosis —1 Could it be a chest condition ?   A basal pneumonia, or a diaphragmatic pleurisy ?   This was excluded because, seventy-two hours after the onset of the pain, there were no definite signs, the respirations were only 24, and the pulse-rate was 68

2 Could it be an abdominal condition—especially a small perforation into the lesser sac ?   This was excluded because an extensive exploration at operation had revealed nothing , the pulse seventy-two hours after the onset of the symptoms was still 68 , there was no pain in the left shoulder , abdominal movements were still present, and respirations were not laboured

3 Was the lesion in the abdominal wall a neuroma, or the nipping of an intercostal nerve by a fractured costal cartilage ?   Against the latter was the absence of injury, and although there was evidently a separation of the costal cartilage, movement of it did not always produce the severe pain

4 Eventually I came to the conclusion that none of the foregoing theories accounted for the symptoms and decided that we were dealing with a case of localized tetanus, and that during a spasm the 10th costal cartilage had been separated from the rib above   The patient was therefore immediately given all the available antitoxin

That the diagnosis was correct was proved by subsequent evidence   (1) In spite of treatment the spasms spread and ultimately involved the jaw to a slight degree   (2) The *Bacillus tetani* was isolated and grown by Dr J L Rentoul from a smear of the pus from the sinus   (3) Under treatment by 6000 units of antitoxin daily the spasms diminished in their frequency, but their intensity remained unabated for about ten days, so that on three occasions the patient burst the abdominal sutures and almost eviscerated himself   After the third of these he developed a low form of peritonitis with hiccough and vomiting, which became fecal and he died on the twenty-fourth day after the laparotomy   Had it not been for the abdominal wound, recovery would, I think, have taken place, as no spasms had occurred after the fourteenth day

This appears to me to be an example of abdominothoracic tetanus of the type described by P L Marie, and quoted by Bruce and Golla in their book *Abnormal Forms of Tetanus*

TORSION OF THE GALL-BLADDER

By S T IRWIN, Belfast

THE rarity of this condition, judging by references to it in literature, leads me to report the following case

On March 21 I was asked to see a case of 'acute abdomen' at the Royal Victoria Hospital, Belfast The patient was a woman, age 34, married, with one child 6 months old Twenty-six hours before admission she was suddenly seized with an acute attack of epigastric pain The pain was very severe, requiring a hypodermic injection of morphia She vomited frequently throughout the night, but this did not relieve the pain Vomiting had ceased before she came into hospital The bowels had acted three times after the onset of the pain

On Admission, she complained of severe pain in the epigastric region, rather to the right side, which went through to the back but not upwards nor into the right shoulder She had not vomited for some hours, and an enema had been returned without fæcal result

On Examination, her temperature was 99°, pulse 90, and respirations 24 She was not jaundiced , her abdomen was not distended , there was no visible peristalsis , the Newcastle sign of perforation was absent , respiration was not confined to the thorax The abdomen was generally rigid, but rigidity was most marked above the umbilicus There was great tenderness over the gall-bladder especially on deep pressure, but there was also localized tenderness at McBurney's point Hyperæsthesia (Light) was most marked at the appendix point There was no phlegmon to be felt, either in the gall bladder or appendix region Rectal examination was negative

Previous History—There was a history of attacks of 'biliousness since girlhood, and a constant condition of bronchial catarrh, which could be heard without the use of the stethoscope Immediately after her confinement, six months previously, she had a pain similar to the present one, but less severe This pain persisted in a modified form during the whole lying-in period, but there had been a clear interval between then and the onset of the attack under review

Diagnosis—This seemed to lie between a gall-stone blocking the cystic duct and an acute appendicitis The former view seemed the more likely, for the pain after twenty six hours was still in the epigastrium, there was marked tenderness on deep pressure over the gall-bladder, and the rigidity was most marked in the upper abdomen The doubt in the case arose from the well-defined area of hyperæsthesia in the appendix region, which suggested an appendicitis complicated by non descent of the cæcum

Operation—Owing to the bronchitis, we decided to explore the upper abdomen under local anæsthesia (2 per cent novocain), having previously given a hypodermic injec tion of ¼ gr morphia and 1/100 gr atropine This revealed a gangrenous gall bladder, tense, black in colour, about the size of a small hen s egg Further investigation under ether anæsthesia proved the condition to have arisen from a torsion of the gall bladder, which had been twisted clockwise through one complete revolution (360°) The twist was situated in the proximal part of the gall-bladder itself, and did not include the spiral valve There was complete strangulation of the blood-vessels, and the contents were chiefly blood, mixed with a trace of bile Cholecystectomy was, therefore, performed, and the subse quent history of the case has been uneventful

Volvulus, or torsion, of the gall-bladder is referred to in the *Medical Annual* of 1913 Moynihan and Upcott quote Kubig, who, in 1912, met with a case post mortem, examined the literature, and found records of three other cases, all in persons of somewhat advanced age Turner and Rowlands refer to the same cases Hansen records the disease in a woman of 79 in whom the gall-bladder was hourglass-shaped The literature, so far as one can trace, comprises seven previous cases, in which the main points are (1) Advanced age of the patient, the present one being an exception (2) The absence of gall stones,

which were found in only one case   (3) The difficulty in accurate diagnosis—apparently not one of the cases was diagnosed before operation   (4) The success following laparotomy in all the cases in which this was undertaken

A list of the references for which I am indebted to Mr H E Powell, Librarian, Royal Society of Medicine, is appended

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OCCIPITAL ENCEPHALOCELE CONTAINING A PROLONGATION FROM A LATERAL CEREBRAL VENTRICLE

By W G SPENCER, London

In the following case the mother of the child said that she had applied to two other London hospitals, at both of which she had been advised against operative treatment   Doubtless the view that operative treatment is contra-indicated accords with the prevailing
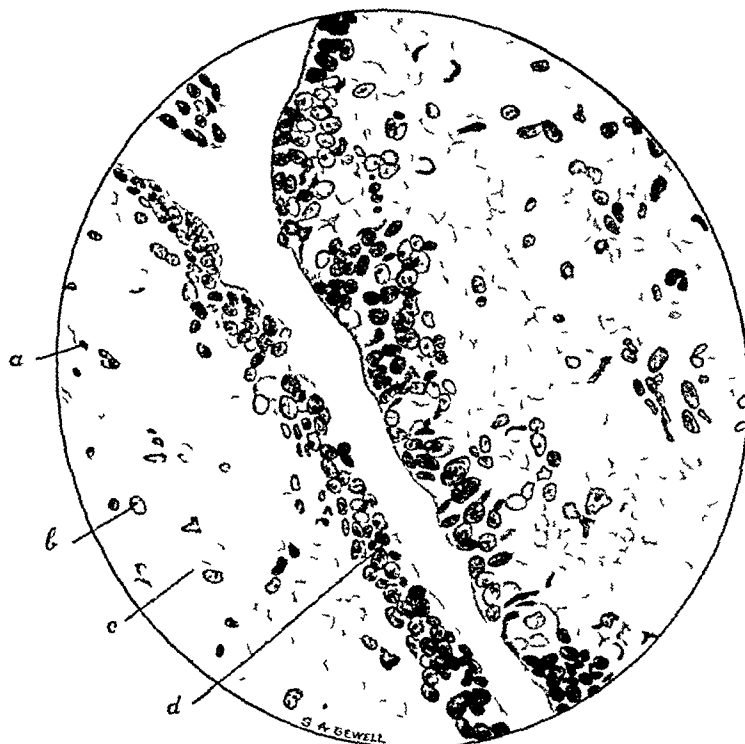
Fig 2 – Transverse section through base of pedicle   (× 220)   *a* Neuroblast   *b* Round cells infiltrating , *c* Myelo pon tum   *d* Ependymal cell

statements in books and with most of the specimens in museums   The encephalocele is generally a protrusion of the cerebellum and 4th ventricle , other deformities, such as

hydrocephalus internus and spina bifida, co exist   Museum specimens of still-born fœtuses present marked arrests of development, both of the brain and skull, along with the protrusion below the tentorium   This child, on the other hand, showed no signs of any other deformity   I had operated on a similar case some years before, and had kept the little boy under observation for two years   A similar success has followed excision in the present instance

The patient, a male, age 1 year 5 months, was admitted to the Westminster Hospital with a swelling having the typical signs of an occipital encephalocele   It had been present
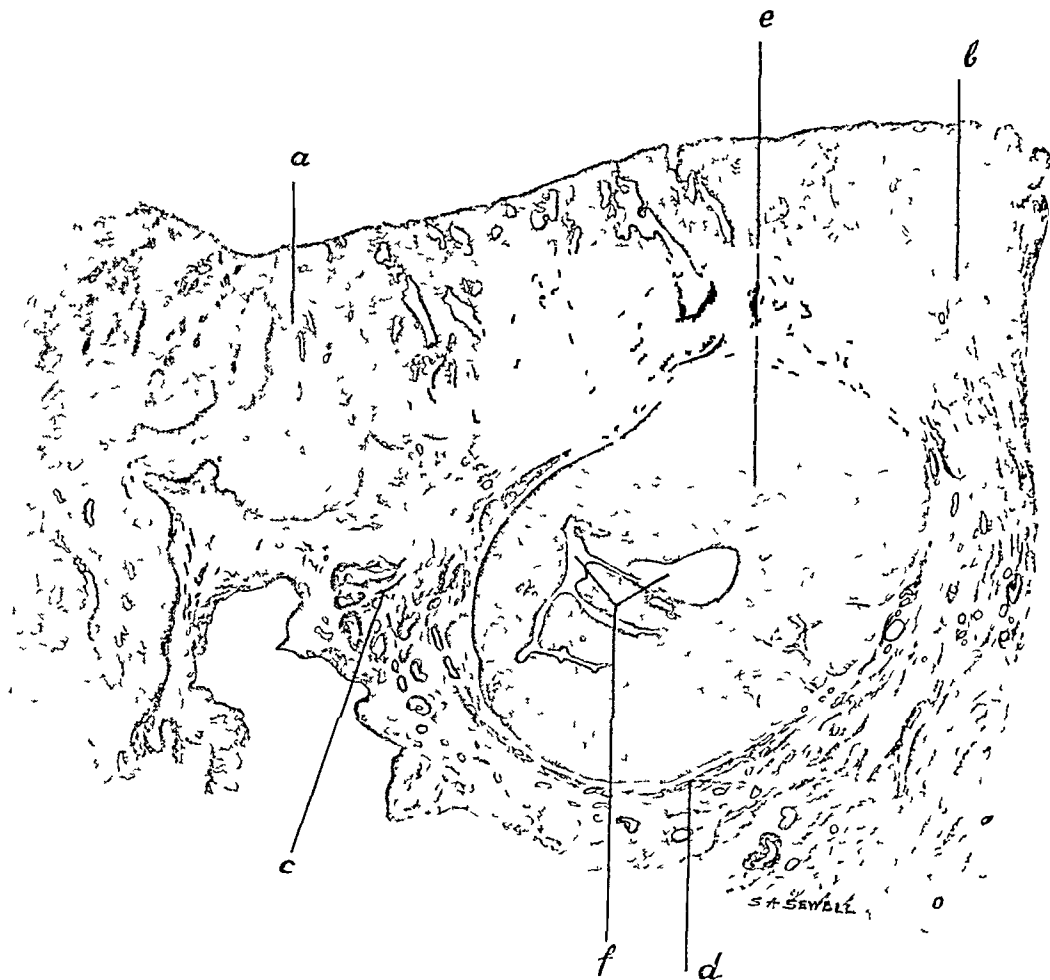
FIG 308 —Transverse section through base of pedicle (× 8) a Tissue derived from pericranium and dura mater b Fibrocellular tissue probably inflammatory in origin   c, d Arachnoid and pia mater e Cerebral wall f Lateral horn of ventricle

from birth, and at times had swelled up to the size of a hen s egg   at times, when the child was unwell, it had become much smaller   The child could neither walk nor talk , it had only one tooth, a lower central incisor   It had been subject to recurring slight attacks, presumably of meningitis, with temporary increase of intracranial tension   The child could hold the head upright, but tended to keep it retracted   There was a scab on the superficial pole of the swelling, due to rubbing on the pillow   The pedicle was too thick for the outline of the gap in the skull to be felt   X-ray examination showed a small hole between the cartilaginous and membranous portions of the occipital bone   An incision

was made round the base of the swelling down to the bone, and the attachments of the pedicle to the margin of the foramen were separated by a raspatory   This enabled the pedicle to be drawn out a little, so that when a ligature was applied and the encephalocele beyond the ligature cut away, the stump sank back within the cranium   Whilst traction was being made on the pedicle the child stopped breathing , but breathing recommenced when the ligatured stump of the pedicle receded   The foramen was circular, about 1 cm in diameter , it was filled by turning in muscle from the occipitalis, over which the occipitalis and skin were separately sutured

The child recovered without complications, and was examined one year and five months after the operation, being then two years and ten months old   He was a bright little boy, who walked beside his mother, talked well, and had all his teeth   Whilst the mother was describing the progress the child had made, the boy ran about and tried to clamber upon a form   There was a slight internal squint of the left eye, which had been only noticed since the operation   The scar was quite sound, and no gap in the skull and no impulse could be felt

The sac removed was covered by normal scalp, underneath which, towards its superficial pole, there was a thin fibrous layer with a smooth lining   Towards the pedicle the various layers were distinguishable—the occipitalis with blood-vessels, the pericranium, the dura mater and arachnoid, and brain-matter around a cavity

Sir Arthur Keith has examined the section of the pedicle close to the level of division, and supervised Mr Sewell's drawings (*Figs 307, 308*)   He thinks that the specimen shows cerebral brain matter and not cerebellar tissue

He has, moreover, re examined a specimen in the Royal College of Surgeons' Museum, and has supplied the following description —

Teratological Series, 340 2

Occipital encephalocele in a stillborn full time child   A dissection on the lateral aspect of the specimen shows that the protrusion has escaped at the upper part of the foramen magnum, while the mesial sagittal section shows that it is made up of folded parts of the occipital lobe which have overridden and compressed the cerebellum—indicated by an arrow

REVIEWS AND NOTICES OF BOOKS

The Spleen and Some of its Diseases Being the Bradshaw Lecture of the R C S of England, 1920 By SIR BERKELEY MOYNIHAN, K C M G , C B Royal 8vo Pp x+129, with 13 full page diagrams 1921 Bristol John Wright & Sons Ltd 21s net

THERE have been numerous works devoted to the spleen , in the rather remote past they dealt mainly with speculations as to its function, and as late as 1876, Patrick Black, physician to St Bartholomew's Hospital, brought out a curious "Essay on the Use of the Spleen, with an Episode of the Spleen's Marriage—a Physiological Love Story" , but coming down to the early years of the present century, the late Sir Frederick Taylor delivered the Lumleian Lectures at the Royal College of Physicians of London for 1904 on "Some Disorders of the Spleen" supplemented in the following year by his inaugural address to the Midland Medical Society on "The Spleen and its Sufferings ", in which he prophetically and rather pathetically remarked that the wonderful advances of surgery made it easier for a surgeon than for a physician to bring forward novel, interesting, and important material In 1917 a valuable contribution on 'The Spleen and Anæmia", by R M Pearce, Professor of Research Medicine, E B Krumbhaar, Assistant Professor of Research Medicine, and C H Frazier, Professor of Clinical Surgery, all of the University of Pennsylvania, struck a fresh note in a piece of team work on this organ, in which a surgeon took his place

Now, with the publication of Sir Berkeley Moynihan's fine monograph, which contains the material collected for the 1920 Bradshaw Lecture of the Royal College of Surgeons of England, a surgeon has boldly and successfully stepped into the field where previously physicians held sway As is well known, Sir Berkeley wrote on the surgery of the spleen in W W Keen's *Surgery*, but he now presents a much wider review of its diseases, and this course is fully justified, not only by the comparatively recent extension of surgical treatment to conditions such as hæmolytic jaundice and pernicious anæmia, but by the need for experienced criticism of the indications for splenectomy Thus, in the description of polycythæmia vera or Vaquez Osler syndrome, a warning is thrown out that, as the spleen tends to keep the plethora within the limits compatible with life, splenectomy should not be performed , again, in regard to the rare cases in which the spleen appears clinically to be the only site of lymphadenoma, it is stated to be very doubtful if its removal has any effect, good or evil, on the progress of this disease

This well got up volume contains thirteen chapters dealing respectively with the anatomy, surgery, and functions of the spleen, the pathology of splenic diseases, the clinical and associated phenomena in splenic disease, pernicious anæmia, leukæmia, Hodgkin's disease, splenic anæmia and Banti's disease, hæmolytic jaundice, Gaucher's disease, von Jaksch's disease and polycythæmia, the differential diagnosis condensed into a table adapted from Krumbhaar, and an interesting discussion on the liver in some of its relations to the spleen Emphasis is rightly laid on the importance of recognizing that abnormal conditions of the spleen are not necessarily confined to that organ, but may cause or be the result of pathological changes elsewhere in the body

The relations between the spleen and other parts of the body, especially the liver and the bone marrow, are illustrated by eight full page diagrams, for which and for help in other ways the author expresses his indebtedness to Dr O C Gruner his assistant in his private laboratory

The history of splenectomy in leukæmia, which until quite recently was widely condemned, is sketched, and here, as in other chapters, the most recent results from the Mayo Clinic (up to September 20, 1920) are quoted , thus in 26 cases of leukæmia submitted to splenectomy there was one immediate fatality, or 4 per cent, but this mortality, so markedly different from that when the large size of the organ was a chief reason for its removal, depends on the previous reduction of the size of the spleen by means of radium In the account of splenic anæmia the view is taken that the anæmia is not necessarily traumatic but may be toxic, and also that the same explanation holds good as to the causation of the gastro intestinal hæmorrhages , this remarkably comprehensive description is made even more complete by the figures from the Mayo Clinic, namely, 73 splenectomies with 9 deaths, or a mortality of 12 per cent

The diagram illustrating the chief changes in hæmolytic jaundice represents "extensive hepatic fibrosis," and in the text the occasional existence of biliary cirrhosis at the necropsy is mentioned , in the discussion on the liver in some of its relations to the spleen it is stated that in hæmolytic jaundice the liver is as greatly enlarged as it is in biliary or hypertrophic cirrhosis, these views are not in accord with general experience, and might therefore perhaps be further elaborated or modified in the second edition that is certain to be required

The chapter on pernicious anæmia contains a personal communication from Dr N M Percy, of Chicago—whose experience of the surgical treatment of the disease is described as unsurpassed—on the diagnostic features that he considers of great importance, namely, absence of hydrochloric acid from the gastric juice, the glossy smooth tongue, cutaneous pigmentation, chronic nephritis, intermittent diarrhœa and vomiting, and nervous manifestations, it is noteworthy that in 95 per cent of his cases there was evidence of focal infection and that among 33 cases operated upon and investigated the gall bladder was infected in 24   The question of splenectomy is discussed in an open minded manner, and no claim for cure is suggested, though half the patients operated upon are improved

In conclusion, this attractively written monograph, which contains interesting historical data with a broad survey of our most recent knowledge, not only presents the results of wide personal experience and thought, but provides both surgeons and physicians with many suggestive ideas

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Genito urinary Surgery and Venereal Diseases   By EDWARD MARTIN, A M , M D , F A C S , BENJAMIN A THOMAS, A M , M D , F A C S , and STIRLING W MOORHEAD, M D   Demy 8vo   Twelfth edition, revised   With 424 engravings and 21 coloured plates   1920   Philadelphia and London   J B Lippincott Company   35s net

THE success of this rather monumental text-book (991 pages   weight 4¼ lb) is attested by its having reached its twelfth edition , the book is so well known to English surgeons that only a few remarks on this new edition will be necessary

Though well bound and clearly printed, the work is heavy and bulky, and difficult to read with any comfort , we think it would have been more convenient if it had been issued in three volumes   The illustrations are quite up to the average and have been carefully chosen, but some of the microphotographs are so poorly reproduced that they convey little information to the reader and might well be omitted

In this work will be found an enormous mass of facts described with clearness and accuracy The searcher after new facts and theories will not find much to interest him, nor must he look therein for any startling deviations from the accepted methods of treatment   We would even go so far as to suggest that the authors' opinions on some questions of genito urinary surgery need revision

On page 10, in the discussion of the treatment of " the bleeding of prostatics ", the authors recommend ' the evacuation of the blood by means of a catheter and syringe and keeping the bladder empty by the retained catheter , if the clots cannot be removed in this way, perineal or suprapubic cystotomy is indicated , if bleeding persists, pressure over the pubis, applied by means of compresses, must be tried "   We consider the last mentioned method extremely ineffectual , surely the removal of the prostate is the best and simplest way to stop prostatic bleeding '   We have done this on several occasions and have found it quite efficient , if, for any reason, it were thought unwise to do a prostatectomy, we should open the bladder suprapubically and apply a gauze packing to the bleeding surface

A surprising omission is to be found under the heading of the treatment of pyelitis (pp 635–6) no mention is made of the administration of alkalis

In the article on nephroptosis (p 592), we find the same list of causes as was set out in our student days , tight lacing seems to have kept its place in the authors' esteem as a cause of movable kidney , yet it is fourteen years ago that we read of Trehah's observations on Arab women, amongst whom corsets are not a la mode , he states that they show a higher percentage of cases of movable kidney than European women   It is true that the authors mention the weight of the hollow viscera as one of the causes, but there is no reference to the work of Sir Arbuthnot Lane on statis and his theory of the pull of the displaced ascending colon on the kidney, nor is Waugh's recent paper mentioned

If, as we think, these are defects in the work, yet they are such as may easily be remedied, and we hasten to add that the book is a valuable work of reference and a tribute to the knowledge and industry of the authors

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Surgical Anatomy of the Temporal Bone   Collection of Lantern Slides, demonstrating the Surgical Anatomy of the Temporal Bone, with Photographs, Catalogue, and Guide   By ARTHUR CHEATLE   F R C S   Set of 200 slides in 5 boxes, with album of 200 photographs and catalogue   1921   London   H K Lewis & Co Ltd   £30

SOME thirty years ago Mr Arthur Cheatle began to collect temporal bones of known age and sex in order to study the changes which come about from growth and age, the anatomical variations which are most commonly met with, the prevailing types of structure, the degree to which the bone of one side is likely to differ from that of the other side, and the changes wrought by disease—all being points of importance to surgeons operating on the ear   In the course of twenty years Mr Cheatle's collection became the most complete and important representation of its kind in the world   In order that other surgeons might share in the fruits of his labour, Mr Cheatle, with great generosity, presented his entire collection to the Museum of the Royal College of Surgeons, where

it is now available for study by all　He not only presented the collection, but prepared and had published a descriptive catalogue guide to it for the use of visitors

Surgeons who attended the Ninth International Otological Congress, held in Boston in 1912, will remember the report which Mr Cheatle communicated on the "Examination of both Temporal Bones from 120 individuals in reference to the question of Symmetry in Health and Disease" Since then he has enriched the collection by many further additions　On this occasion many surgeons expressed a regret that a collection which had cost so much time, trouble, and expense to bring together could not be made available for use in aural cliniques of all lands　In answer to this feeling, Mr Cheatle has made his collection available for teaching purposes by having 200 lantern slides prepared from specimens in his collection—all of them excellent examples of the photographer's art　The slides, with catalogue and guide, can be had for £18, while an album of photographs, in place of the slides, with catalogue and guide, costs £14　The price seems high, but is not more than covers the materials and labour involved　Mr Cheatle deserves the thanks of the medical profession for placing the labour of years so fully at its disposal

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Diathermy its Production and Uses in Medicine and Surgery By ELKIN P CUMBERBATCH, M A Oxon, M R C P, Medical Officer in Charge, Electrical Department, St Bartholomew s Hospital 8vo Pp 193 + x 1921 London William Heinemann 21s net

DIATHERMY is a comparatively new method of treating disease　As the term implies, it is a 'through heating', in which an electric current of a special kind, generated by a special machine, traverses the body　The tissues are, therefore, heated *throughout*

The book opens with an historical note dealing with the work of Tesler and D Arsonval, following a discussion of Nagelschmidt's method, who was really the first to introduce and popularize the new treatment in this country　Various forms of the apparatus are described in detail, and careful illustrations are given, showing the method by which the sparks are obtained

Chapter 5 deals with the physiological effects of diathermy, and it is pointed out that there is a very definite reaction on the part of the tissues to the current　Alterations in the blood pressure are noticed, in one instance there was a fall of 10 mm in the systolic blood pressure, while other charts illustrate the fact that there is a definite increase in the temperature　Generally speaking, as the result of the experiments described in Chapter 6, there is an elevation of temperature, varying from 2° to 9°

Chapter 7 deals with medical diathermy, in which the therapeutic effects of heat are distributed generally, either to the body as a whole, or to the part affected　Careful details are supplied as to the method of application of electrodes, and indications as to the strength of the current required for various conditions

Sections III, IV, and V of this chapter deal with some of the medical conditions for which diathermy has been used with considerable benefit, and they include circulatory disturbances, neuritis, sciatica, arteriosclerosis, paralysis agitans, and gonorrhœal infections

Chapter 8 considers the use of diathermy in surgery, and opens with an illustration indicating the amount of destruction caused when the active electrode is placed in contact with the tissues　In diathermy the electrode is cold when it is placed on or in the tissues, and remains cold until the current passes to it from the negative electrode　Anyone who has seen the cauterizing effect of this diathermy in surgical conditions must be astonished at the wide area of destruction created　Illustrations of the different forms of electrodes for use are figured, and details are given as to their methods of application

In Section IV, the treatment of cases by diathermy is described, and the attention of the reader is directed to the danger of using this process of cauterization in the neighbourhood of large arterial channels, which must always be ligatured as a preliminary, otherwise dangerous, even fatal, secondary hæmorrhage may supervene

In Section V, particulars of some cases treated are given　growths of the mouth and throat, palate, and tonsil, inoperable carcinoma of the breast, rodent ulcer, warts, and papillomata of the bladder　It is in connection with this latter affection that diathermy finds one of its greatest uses in surgery

The book is well printed the illustrations are clear, there is an efficient index, and the author is modest in his claims on behalf of what is, at present, in experimental method of treatment The method, however, will undoubtedly fill an important place in the therapeutics of both medicine and surgery

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The American Year-Book of Anæsthesia and Analgesia Edited by F H McMechan, A M, M D with the help of 84 contributors Vol ii, for the years 1917–1918 Large 4to Pp 471 with 175 illustrations 1921 New York Surgery Publishing Co $10

THI American Year Book of Anæsthesia and Analgesia published in January, 1921, is a comprehensive collection of instructive papers describing researches undertaken and advances made during 1917 and 1918　The Editor has given prominence to subjects of clinical importance, and has placed side by side articles by authors holding opposite views, thus supplying the reader with

evidence from which to form his own opinion in matters of a controversial nature. In some instances, however, the contradictory statements contained in papers by different authors fail to be of value owing to lack of data. For example, Mytinger states that in anæsthetizing epileptics, convulsive seizures are almost constantly to be dealt with; on the other hand Collier, with a large experience, finds it exceptional to see a convulsive attack. If Mytinger had given details of the methods of anæsthesia employed by him, some useful deductions might have been obvious.

In the section on complicating factors of anæsthesia are two contributions on heart lesions by Willius and Richardson respectively. Willius is of opinion that ' the general tendency is to require too great a margin of cardiac safety in surgical work ", he has taken as his material such lesions as mitral stenosis, aortic disease, auricular fibrillation, and auricular flutter, it would have enhanced the value of his work if his material had included also such lesions as fatty degeneration, septic myocarditis, and pericarditis.

Richardson deprecates the use of scopolamine in patients with cardiac lesions, and repeats the warning note as to the delusion that gas and oxygen is the safest of all general anæsthetics— he holds the opinion that this anæsthetic is far from safe in cases of broken compensation and angina pectoris. With reference to the use of ether and chloroform in these cases, Richardson lays stress on the importance of " mixing the drugs on the mask as indicated and not according to any preconceived formula "

The history of open ether, from its introduction in 1893 by Dr Prince up to the present time, is well described by Dr Herb, who makes several points in favour of this, as compared with other methods of ether administration, and gives strong reasons for concluding that the conservation of body heat is ' of much greater importance than is the warming of the ether vapour " This question of the value or otherwise of warming ether vapour is discussed from different points of view by Shipway and Pembrey on the one hand, and McCarty and Davis on the other.

Munn, of Rochester, has contributed two valuable papers on the effects of etherization upon the blood and upon the vascular reflexes in which he shows that with surgical degrees of etherization phagocytosis is increased and not decreased; also that with ether tension high enough to abolish the corneal reflex the blood pressure falls, and that there is less tendency to a fall with lower degrees of ether tension such as produce so called ' light anæsthesia " The work of Muns on shock has also a bearing on this problem of what is the best degree of etherization for the purpose of preventing shock; the author maintains that shock is produced by surgical stimuli and by ether stimuli, and that these two factors ought ' to be properly balanced "

Embley's remarks concerning the physio pathology of ethyl chloride will be of interest to many anæsthetists who wonder why this drug is not more popular. The salient points elicited by this piece of research are that ethyl chloride causes lowered blood pressure through a weakened action of the heart, and that vagus danger is due to concentration of the anæsthetic, which can be regarded as comparatively safe only when care is taken that the corneal reflex is not abolished.

The experiences of anæsthetists in war surgery are interestingly written by Howell, Marshall, Corfield, and Vignes abroad, and McCardie, Silk, Boyle, and Clarke at home.

The section on local anæsthesia is well illustrated and contains good detailed accounts of the technique necessary for successful analgesia in various operations, including appendicectomy, hæmmorrhoid tissue in section, thyroidectomy, and others.

The index of current literature of anæsthesia will be helpful to students investigating any particular branch of this subject; the book as a whole is extremely interesting, and abounds in useful information.

Indispensable Orthopædics. By F CALOT, Surgeon in Chief to the Orthopædic Institute at Berck. Second English edition, translated from the seventh French edition by A H ROBINSON M D, M R C S. Large 8vo. Pp xii + 1108, with 1140 figures and 8 coloured plates. 1921. London: Baillere, Tindall & Cox. 42s net.

This important book undoubtedly represents the fullest and most authoritative work on the subject of conservative surgical treatment of bone and joint tuberculosis, and it also gives a good account of the orthopædic affections.

The importance of the treatment of bone and joint tuberculosis by immobilization, open air, and heliotherapy was never greater than to day, because whilst most medical practitioners and surgeons are convinced that operative measures should play only a minor part in this matter, they are by no means familiar with the necessities of the conservative methods.

The author in his preface and in the text writes as though his object was to instruct the general practitioner how to undertake the treatment of these cases himself. We feel quite sure that this is entirely wrong. Let any medical man visit the institute at Berck Plage or at Alton and then ask himself " Am I justified in keeping early cases of hip or spinal disease under my own care when I might send them to an institute ? " It is the greatest mistake to think that conservative treatment is easier than operative. It may be true that the puncture and aspiration of an abscess is an easy thing, but the efficient mechanical and hygienic treatment of the case requires judgement, patience, and the resources of a special institute.

The opening chapters of the book dealing with methods and apparatus are invaluable for their wealth and clearness of detail. The book does not deal with any complicated operative procedures

such as bone grafting or open operations for congenital dislocation of the hip, and in this respect is an incomplete presentation of modern orthopædic surgery   But it represents the outcome of long and patient work with a vast number of patients, and it thus forms the most authoritative exposition of conservative orthopædics

The present edition has relegated Abbott's treatment of scoliosis to a very minor place, the subjects of adult coxa vara and the surgical treatment of infantile paralysis are dealt with at greater length

The illustrations are clear and profuse, and the English text is beyond criticism

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Urologische Operationslehre (Essays on the Operative Surgery of the Urinary Organs)   Edited by Professor DR VOELCKER and the late Professor DR WOSSIDLO   Pp 572, with 445 illustrations, some of which are coloured, and 3 coloured plates   1921   Leipzig   George Thieme   Unbound, M 190 , bound, M 225

THIS book consists of essays by eleven authors on the operative surgery of the genito urinary organs , the title 'urologische' is a misnomer, as operations on the testicle, the vas, and the seminal vesicles are included

The volume is a most attractive one, being well bound, well printed, and most excellently illustrated   The various chapters are not all of the same value, as is almost inevitable in a work of a collective nature , on the whole, however, the level maintained is very high

The chapters by Prof Dr Kummell, of Hamburg, are particularly well written and of great interest , they deal with the operations on the kidney and its pelvis   As well written, but of even more interest are the articles by Prof Dr Voelcker, of Halle, who writes on the operative surgery of the bladder , they contain several original observations and suggestions, and are thoroughly up to date

The heading of this chapter by Voelcker (Blutige Operationen der Harnblase) is difficult to translate , perhaps 'open operations' is the nearest approach in our language , it seems to us to be an unfortunate term to apply to these operations, as they by no means possess a monopoly in the shedding of blood

The value of the book is enhanced by the excellent bibliography appended to each section this is not intended to be exhaustive, but to direct the reader to the best that has been written on the subject   It is curious to observe how often German, American, and even French authors are quoted, and how seldom the British urologist figures in these lists , only five are mentioned, and one of these is disguised under the alias of 'H Tompson'

The editing has been most conscientious, and there are very few misprints , we consider that this volume is worth the labour of translation

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The Principles and Practice of Surgery   By HERMAN A HAYAULD, Clinical Professor of Surgery in New York University   2 vols   Large 8vo   Pp 2482, with 1044 figures   1921   New York and London   D Appleton and Co   £4 4s net

THIS new American text book of surgery is a carefully written and well proportioned work   It has the advantages and the disadvantages of a one man book as compared with a system by many authors, but we are inclined to think that in this case the former outweigh the latter

The first volume deals with wounds, infections, necrosis, injuries, and tumours   The section on bacteriology and the pathology of infective diseases is full and complete, occupying nearly one fifth of the whole work

The second volume describes deformities, the surgery of the spine, head, neck, face, chest and abdomen

The latter section, including the surgery of the rectum and genito urinary system, is compressed into a little more than five hundred pages, which necessitates a very great curtailment of the many subjects treated   Nevertheless we are bound to admit the great skill and judgement on the part of the author in including the essential points of every part of his subject

The work is an academical summary of surgical principles and practice rather than a practical guide to the student or practitioner   A noteworthy feature is the reference to articles in the literature which ends each chapter , but we think this might have been improved if references to original articles instead of to quotations had been given   For example, one reads with some interest that Buck is to be credited with originating the idea of the extension treatment of fractures , but on turning up the reference we are referred to a quotation by von Volkmann in Pitha Billroth's handbook

The illustrations do not compare favourably with those of modern text books, and we think that there has been a want of judgement in giving many figures of operations such as those of arthroplasty of the hip and knee and resection of the posterior nerve roots, and leaving unillustrated more common operations the results of which are in less dispute

Nevertheless we think that the book as a whole presents a very fair and well balanced summary of the science and art of surgery

General Practice and X Rays a Handbook for the General Practitioner and Student By ALICE V KNOX, M B, B Ch With chapters on Instrumentation by ROBERT KNOX, M D Crown 8vo Pp 214, with 88 illustrations 1921 London A & C Black 15s net

UNDER the above heading a most useful little manual has been published by Messrs A & C Black in The Edinburgh Medical Series It supplies a long felt need in giving to the general practitioner a good idea of the scope of modern x rays

There has been a prevalent idea that the only useful function of x ray examination lies in the elucidation of fractures, and injuries to bones and joints This book indicates clearly the many other spheres of usefulness for x ray examination It is divided into two portions—the first deals fully with the value of x rays in diagnosis, and indicates clearly the many directions in which they prove helpful Another chapter, also very necessary, reviews their position in regard to the treatment of disease This is good, but very brief

The second part deals with the instruments necessary to the production of x rays It is clearly and concisely written, and explains to the uninitiated the methods and apparatus used

Radiology is a science which is advancing by leaps and bounds, and remarks made to day are almost history to morrow This book is of great service because of the clear way it demonstrates what can be done in diagnosis and treatment by modern x ray apparatus

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Diseases of the Ear By PHILIP D KERRISON, M D Second edition, revised and enlarged Pp xxii + 596, with 332 illustrations in text and 2 full pages in colour 1921 Philadelphia and London J B Lippincott Company 35s net

WE can thoroughly recommend this excellent book Whether it be the general surgeon who refers to it because he must occasionally tackle an acute mastoid, the young otologist who desires help in the treatment of an acute otitis media, or the more experienced man who looks for guidance in a difficult case of brain abscess, each will find something that he needs in the volume We believe that the book will take the place that Politzer has so long held on our shelves, with this difference, that it is far more readable than the Austrian book, and in it a single point can much more readily be looked up

The book is essentially practical, but with this the scientific work done on the ear is well blended, above all, the author is clearly a man of principle who has his patient's welfare first before him It is not to be expected that anyone will agree with everything that is said in a volume of this size When he wants an independent view the author is able to take it, and is prepared to break with tradition if he thinks the evidence demands it It is hard in such a work to pick out one chapter above the others We have found that on labyrinthine disease particularly useful, the clinical varieties of labyrinthitis are well differentiated, and the tests, and the physiology of the vestibule are set out as clearly perhaps as is possible The chapter shows us how very little we knew of the subject, and how conjectural is much that we believe we do know

We wish this book every success on both sides of the Atlantic, and shall be pleased to welcome its author in the event of his crossing over to ours

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Clinical Surgery by Case Histories By ARTHUR E HERTZLER, M D, Ph D, F A C S, Professor of Surgery in the University of Kansas In 2 vols Pp 1083, with 483 illustrations 1921 London Henry Kimpton £5 net

THESE volumes deal with the whole range of clinical surgery from a novel point of view, that of case histories, in fact, the volumes are made up almost entirely of case histories arranged topographically

The practical side of surgery is kept to the fore emphasis being laid on diagnosis and indications for treatment The books are profusely illustrated by nearly five hundred photographs, including skiagrams and micro photographs these the author rightly considers a very valuable feature of the work

The first twenty eight pages are devoted to general principles, and bristle with poignant remarks, which all surgeons may well read For instance " The surgeon must have a 'change of pace' as the baseball pitchers say " ' Once the surgeon has diagnosed the disease he must diagnose the patient " Some operate rapidly, one might say uproariously " Pathology has been presented with

Case histories then follow, each being detailed under the headings of history, examination, diagnosis, treatment, pathology, after course, and comment at the Halstead Hospital, and each has been selected on account of some outstanding point of interest, as the writer says, they represent the cases have all been under observation a book which is essentially sober after thought rather than ' achievement on parade " the greatest possible brevity, this obviously being the best plan in clinical

We can strongly recommend the reading of this work It has an attractive freshness, and a freedom from convention and tradition, it is brimful of common sense and gives one an opportunity of reviewing clinical cases from a new and practical standpoint

On Bone Formation its Relation to Tension and Pressure   By Dr Murk Jansrn, O B F , Lecturer on Orthopædic Surgery, University of Leiden   Large 8vo   Pp 114, 54 figures   1920   London   Longmans, Green & Co   20s net

IT is refreshing to read a surgical book of to day which is frankly non utilitarian in its aim and scope   After a short review of the literature dealing with the subject of pressure and tension in their relation to bone formation, the author discusses the problem of the internal architecture of various normal and morbid bones   His main thesis is that tension forces have no part in the determination of the structure of bones, but that pressure force is the sole and dominating factor These problems are discussed in relation to the upper end of the femur, the calcaneum, the ankylosed knee, the mandible, and cranial bones   After a detailed consideration of the conditions of origin of cancellous tissue, the final chapters deal with bone formation, the form of bones, and the purposive factors in bone formation

Perhaps the most suggestive parts of the book are those which deal with the reaction of bone tissue to pressure and the conditions in which this will lead either to growth or absorption

Considering the highly abstruse nature of the subject, the author may be congratulated on the clearness of language in which it is expressed   The photographs of macerated bones in section form one of the most valuable features of the work

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Injuries and Diseases of the Bones and Joints   their Differential Diagnosis by means of the Roentgen Rays   By F H Baetjer, M D , and C A Waters, M D   Royal 8vo Pp 349, with 333 illustrations   1921   London   H K Lewis & Co Ltd   £3 10s net

THIS most valuable and up to date work consists of a veritable atlas of the skiagrams of normal, injured and diseased bones and joints   Accompanying the pictures is a clearly written account of these conditions, principally with a view to aiding diagnosis   No doubt in future editions the value of the work will be increased by the inclusion of a greater number of pictures of different varieties of the complicated types of fracture, such as those of the pelvis

The results of special forms of treatment, such as bone grafting, are only dealt with very briefly, and this too, we think might be enlarged with advantage

A remarkably complete and typical collection of different forms of bone tumour is presented, and there are several figures illustrating hæmophilia

The section on tuberculous disease of the spine is poorly illustrated, and we should have thought the importance of this part of the subject would have deserved much fuller treatment

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Chirurgie de Guerre et d apres Guerre   By Auguste Broca   Royal 8vo   Pp 479, with 545 figures   1921   Paris   Masson & Co   25 fr

MANY British surgeons will be familiar with the two War Medical Manuals which this writer published de iling with the immediate and late effects of wounds of the bones and joints   This volume appears to be in the main an amplification of those two small books, and deals almost entirely with similar subjects   The first chapters deal with the general organization of the hospitals in which the author worked, and with statistics , those that mention the former are not full enough to in struct anyone unfamiliar with the general outline of the French Medical Service, and to those who are they would be superfluous   the statistics are founded on less than 3000 cases, and are of course liable to the usual errors if in attempt is made to follow out any deduction from them

The general principles of wound treatment, removal of foreign bodies, etc , seem to be those which were approved by British surgeons , we get no chapter on recent abdominal wounds, for the author had no experience of such   He does not suggest that he obtained any definite opinion as to the value of exploration with a needle in vague chest conditions, or as to the necessity of evacuating collections of blood in the pleura—questions which we know were being hotly debated in French surgical societies at the very time these cases were being treated

The chapters on the late treatment of wounds of joints and bones are those which justify the publication of the volume , much of their interest centres round the question of esquillectomy, and Broca argues in favour of a moderate, delayed operation, much, we believe, as most British surgeons would, and makes a good case for his view that this is really what Ollier held, even though his followers have argued that he favoured esquillectomy, primary and ' large '

It is an obviously honest candid picture of a personal but limited experience , is it unfair to admit to being disappointed in deriving from its perusal no more defined and clear cut views ?   If so, the blame must be given to the author's earlier writings, from which we were led to anticipate a much clearer surgical vision than this volume displays

THE TUBE SKIN-FLAP IN PLASTIC SURGERY.

By H P PICKERILL AND J RENFREW WHITE DUNEDIN, NEW ZEALAND

THE exact origin of the tube flap is difficult to trace Many unlined flat flaps, if they lived converted themselves into tube-flaps by reason of the cicatricial contraction which resulted on their under surfaces This may have originated the observation that if a long flap did not die it became a tube, and conversely, that a tubed flap would be more viable than a flat flap (See Fig 324) It does not, however seem to have attracted any particular notice, since no text-books mention it The kinemato-plastic flaps of Vanghetti and Putti depend for their viability and usefulness upon the adoption of the tube form, although these authors do not draw attention to this fact

The tube flap probably was first extensively used as a means of maintaining the nourishment of large flaps at the Queen s Hospital, Sidcup, during the war, when it was extensively employed by Major Gillies Major Waldron Lieutenant-Colonel Newland, and one of the writers (H P P) It was then chiefly used for the purpose of conveying tissues from the chest or low down on the neck to some part of the face, with extraordinarily satisfactory results The tube-flap and tube-graft are, however, capable of considerable extension of usefulness, and it is with the object of calling attention to this aspect that the present communication is made

THE TUBE-FLAP AND THE TUBE-GRAFT IN FACIAL SURGERY

By H P PICKERILL

The tube flap in plastic facial surgery is used to convey tissue to the face from the chest neck scalp or forehead in a viable condition It has the obvious advantage—besides that of almost certain vitality—of avoiding additional scars on the face , in fact so great an advantage is this that the author has now almost entirely abandoned the practice of cutting flaps from one part of the face to remedy a loss or defect of some other part of the face So far as present observations go, the limit of length of such tube-flaps has not been reached (Figs 327, 328 329)

Technique of the Operation—A neck tube-flap is fashioned as follows —

1 Two parallel incisions are made along the line of the sternomastoid about 2 inches apart The skin subcutaneous tissue, and platysma are then dissected off the sternomastoid thus forming a broad flat flap The two edges of the flap are now brought together with the skin surface outwards and sutured accurately, thus forming a 'tube The skin margins of the wound are then freely undermined and brought together, leaving the tube hanging free for the greater part of its length, but united to the neck at its upper and lower ends (Fig 310)

The author prefers in this class of tube—i e , where there is no direct arterial supply or venous return—to leave it for ten days or a fortnight until the margins have well united before swinging it up on to the face By this procedure the possibility of the introduction of sepsis into the length of the tube is considerably lessened (Fig 311) This of course is a most important point since any serious sepsis in the substance of the tube if it extends across its whole diameter is almost equal to dividing it with a knife as far as the vitality of the free end of the graft is concerned

2 The lower end of the tube with or without any additional flat flap, is divided, swung up to the face and inserted accurately in its prepared bed (Fig 312)

3 At the end of ten days the tube is divided at its distal end and opened out flat again The scar in the neck is excised and the flap reinserted into the neck, thus the only tissue ultimately lost from the neck is from the lower end near or below the clavicle

Fig 309

Fig 310

Fig 311

Fig 312

Fig 313

Fig 314

Fig 309 —Total loss of upper and lower lips Illustrates the type of case suitable for restoration by tube graft Aug 18 1917

Fig 310 —Shows either a tube flap or tube graft in process of formation from the neck

Fig 311 —Tube flap formed from the neck hanging free except for attachment at both end It remains thus for ten days when its lower end is divided and the graft swung into the desired position

Fig 312 —Tube graft swung into prepared position for restoration of the lower lip Tube still attached at its posterior end

Fig 313 —Double tube flap formed by the superimposition of a scalp flap upon the neck flap Preliminary to the for restoration of upper lip

The neck flap (derived from what was not required for the restoration of the lower lip) serve as an artificial mucous membrane and the scalp flap is the outer skin of the upper lip thus enabling the patient to grow a moustache if desired

Fig 314 —Shows complete restoration of upper and lower lips of patient shown in Fig 309 by mean of tube grafts Dec 8 1917

This area if large can always be skin-grafted, and in any case is in a favourable situation (Fig 320)

4 Caterpillar grafts Should the tube not be long enough for its original intention (indeed it may sometimes with advantage be purposely made short), it may be 'cater

pillared into place   To accomplish this the lower end of the tube is divided, swung upwards and inserted into a small prepared bed as high up as possible   At the end of ten days this process is repeated   The lower (original proximal) end being divided, swung up and in turn inserted in a small prepared bed—and so on until the desired situation is reached (*Fig* 315)

Small adventitious blood vessels develop into the ends of such caterpillared tubes with astonishing rapidity   A certain allowance has to be made for shrinkage in length of all tube grafts but given absolute asepsis this should not amount to more than one-sixth

A similar technique is employed with tube-grafts in other situations except that where there is an assured blood-supply the tube may be made and the flap brought into position at one operation   For instance in a lateral temporal or parietal tube flap containing branches of the superficial temporary artery and vein, the tube and flap may be at once cut, formed and swung into position on the nose or chin as the case may be, without any fear of loss of vitality of the distal end of the flap (*Figs* 316 and 317)

FIG 315   FIG 316   FIG 317

FIG 315 Caterpillar tube graft from neck for restoration of lower lip

FIG 316 —Lateral temporo frontal tube flap for restoration of lost tip of nose The flap containing the anterior branch of the superficial temporal artery, can be brought down immediately into the desired position   It has a very high vitality (Photograph taken after the application of iodine) Sept 25, 1919

FIG 317 —Restoration of tip of nose shown in *Fig* 316   The tube graft has been divided opened out, and returned to its original position   The area not covered by returned pedicle has been grafted by a whole thickness pressure skin graft Nov 7 1919

The Tube graft — This name may be applied to a variation of the tube-flap when the tube form is itself used for the graft and not merely as a carrier of nourishment (*Figs* 312 and 313)

Such tube grafts are particularly useful in the restoration of lips and the repair of palatal defects or any similar situation   The technique of the operation is the same except that the tube is allowed to hang for at least a fortnight by when it becomes slightly congested and acquires a rose flush which, when it is grafted into position to form a lip it never loses   Incredible is it may appear it is nevertheless quite true that it is very difficult to tell afterwards which is the mucous membrane lip and which skin

For palatal defects the margins and posterior end of the defect are pared and the tube split along each side and sutured into position accurately   At the end of a fortnight the tube is divided and sutures are inserted along the anterior margin of the defect   The lower and unwanted portion of the tube is returned to the neck (*Figs* 321 322, 323)

There is occasionally a tendency to scar formation along the margins of the returned flap, but this I am satisfied is due to too early movement of the neck by the patient and may be entirely obviated by the use of plaster bandages

Fig 318

Fig 319

Fig 320

Fig 318 — Loss of chin Suitable for restoration by double tube flaps Dec 1 1918
Fig 319 — Double tube flap from scalp and neck for restoration of chin (see Fig 318) The scalp flap contains the posterior branch of the superficial temporal arters and so may be swung down immediately It imparts considerable vitality to the underlying neck tube flap
Fig 320 — Shows the complete restoration of chin (cf Fig 18) The tube flap pedicles as can be seen, have been opened out and returned to their respective previous positions March 3 1919

ADVANTAGES —Smooth skin inside the mouth, hair bearing skin outside, and no additional scarring or tension of the face or neck
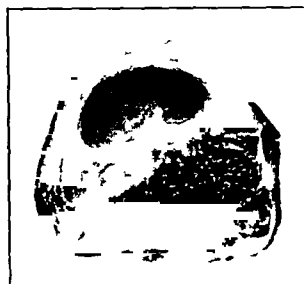
Fig 321

Fig 322

Fig 323

Fig 321 — Plaster cast of palatal defect suitable for restoration by means of a tube graft Jan 6 19_0
Fig 322 — Tube graft fashioned from the neck and passed in through the mouth to remedy the defect shown in Fig 21 The lip were sutured together temporarily to prevent movement No very efficient anti eptic precautions were possible yet the graft took perfectly Jan 23 1920
Fig —Plaster cast of restoration by tube graft of defect shown in Fig 21 Feb 16 19_0

The Double Tube flap —This is a modification which is particularly useful in chin and cheek restorations or in the closure of any hollow viscus which requires an epithelial lining   It consists essentially of a tube-flap of plain smooth skin formed from the neck swung upwards and adapted to the defect with its skin surface inwards towards the mouth and its raw surface outwards   Immediately, and at the same operation of course, another tube-flap is fashioned from elsewhere—the scalp, for instance—and turned down to lie

over the first flap, to which it is accurately adapted   Ten days afterwards both tubes are divided, and returned to their respective original positions

FIG 324   FIG 325   FIG 326
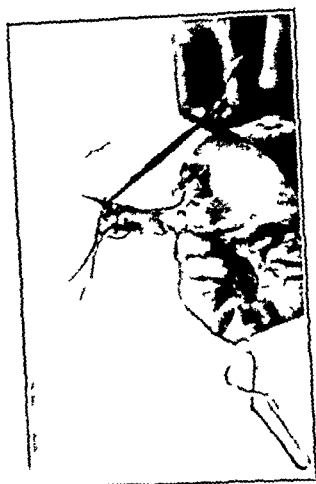
FIG 324 — An unlined rhinoplastic flap which had become detached from the margins of the nasal cavity, and had converted itself into a tube   The tube was opened out and returned to its original position on the forehead   The nasal restoration was carried out subsequently by a chest tube-flap (see Figs 325 and 326)   Nov 27 1918

FIG 325   Rhinoplastic restoration by neck and chest tube flap of case shown in Fig 324   The under surface of the chest flap was skin grafted before being swung up into position in order to have an epithelial lining on the internal nasal surface

FIG 326   Rhinoplastic restoration by means of neck chest tube   Tube pedicle divided and returned to neck, having tissue imported from chest in situ on nose   March 14, 1919

There remains to repair the defect a complete island of tissues imported from two situations at a considerable distance, lined by smooth hairless skin on the inside and by hair-bearing skin on the outside (Figs 318 319 320)

FIG 318   FIG 319   FIG 320

FIG 318   Tube flap formed on left side of chest for replacing keloid scar on right side of neck   The keloid had recurred several times and radium had been applied without use   The tube could not be formed on the right side owing to the position of a large scar on the right shoulder   Jan 4 1919

FIG 319   Lower end of tube flap opened out and swung upward to replace the upper portion of the excised keloid

FIG 320   Upper end of tube flap shown in Fig 327 divided opened out and swung across to replace the lower portion of the excised keloid   Photo taken soon after removal of stitches and before massage had softened the scar   March 14 1919

A similar method to this would be of considerable advantage in dealing with such defects as ectopia vesicæ

Previous to devising the double tube-flap, it was customary to obtain a lining in chin and cheek losses by turning up a flat flap from the neck in the immediate vicinity of the loss, the 'hinge' of the flap being the lower margin of the defect This had the obvious disadvantage in men of employing a hair-bearing surface inside the mouth, which proved exceedingly disagreeable and annoying to the patient It was the undesirability of this procedure which led the writer to devise the tube-graft and the double tube flap for such cases

Viability of Tube-flaps—The extraordinary effect that tubing a flap has on its vitality is evidenced by the fact that, after tubing, a flap may be grafted into a septic cavity like the mouth or nose, or on to a septic surface (chronic ulcers) with almost a certainty of its survival (*Figs* 321, 322, 323) This has suggested that after the removal of malignant growths from the face or jaws the loss should, when practicable, be immediately made good, or the raw area grafted by a tubed flap, with the idea of (a) minimizing sepsis, (b) preventing contraction, (c) bringing up an additional blood-supply and fresh tissue from an area not liable to such lesions

The author is at present utilizing this method, and hopes to make it the subject of a further communication

THE USE OF THE TUBED-PEDICLED SKIN-GRAFT IN THE SURGERY OF THE LIMBS

By J RENFREW WHITE

So far as the writer knows, the method of importing skin-flaps from a distance by means of the tubed pedicled skin graft has been used up to the present only in the plastic repair of facial injuries and diseases   Invented by the surgeons working at the Queen's Hospital for Facial Injuries at Sidcup, it was first brought to the notice of the writer by the brilliant results obtained in the cases of facial injury among New Zealand soldiers treated by Lieutenant-Colonel H P Pickerill, N Z M C, the New Zealand surgeon at Sidcup

The writer was at once struck by the possibilities of this form of skin grafting, the ease and certainty with which the importation of large areas of normal skin to fill extensive skin defects could be carried out from so great a distance from the face as the neck the top of the scalp, or the front of the chest—as exemplified by Colonel Pickerill's work—stimulated the writer to experiment with this method in the case of large skin defects and ulcers of the limbs

Opportunities for these experiments were far from lacking, like every other surgeon engaged in treating orthopedic cases among the wounded, the writer had experience of numerous cases in which the destruction of a considerable area of skin in the limbs had led to the formation of chronic traumatic ulcers with hard indurated circumference and base, ulcers that could only be coaxed into healing with the greatest difficulty or that had defied all forms of treatment, including the usual methods of skin grafting   It seemed to the writer that if this new method of importing healthy skin from a distance could be made applicable to such cases the problem of healing them would be solved

At the outset it was apparent, however, that there were important differences between the use of this method in the facial cases and its possible use in these cases of chronic ulceration   In the first place, it seemed doubtful whether skin tubes cut from the limbs would be able to develop so good a blood-supply as those cut from skin so richly vascular as that of the scalp and the neck, were it for this reason found impossible to cut long tubes that would remain viable, this would necessitate such a reduction in the length of the tubed pedicle that it would be impossible to transplant skin over the necessary distance—for instance, from the inside of one leg to the inner or outer aspect of the other   A further important difference lay in the fact that the facial surgeons who used this method had always transplanted the skin flaps on to clean aseptic surfaces to

which the imported skin had at once adhered and from which it very soon derived an additional supply of blood, whereas it was to effect the healing of chronically infected discharging ulcers that the writer proposed to try this method

It seemed reasonable to suppose—what subsequent experience proved to be true—that it would take a much longer and in different cases, a very variable period for the imported pedicle flap to adhere to the infected surface and to gain from it a blood-supply sufficient to ensure its survival after the division of its pedicle

Despite some early failures, which, with fuller knowledge and experience, the writer feels confident he could now avoid, the experiments have had so gratifying a measure of success that he has determined to publish an account of the technique and results of this method of obtaining certain and permanent healing in a class of case that has hitherto been notorious for the difficulty and uncertainty of its cure

FIG 330 This shows the result of the second stage in the treatment of a chronic cavity in the lower end of the radius the end result of a year old process of a teomyelitis No tissue could be obtained locally to fill this cavity a large skin tube was therefore formed down the side of the chest after a fortnight its lower attached end was divided opened out and sutured into position so as to fill the cavity

FIG 331 The final stage of this plastic closure of the o teomyelitic cavity in the lower end of the radius

The photograph was taken one year after that of Fig 330 The cavity has remained healed all this time It was found necessary to wait three weeks in the case before dividing the tubed pedicle as it took all that time for the imported flap to adhere sufficiently to the granulating wall and floor of the cavity to get an adequate blood supply

Why these chronic ulcers refuse to heal spontaneously—Chronic ulcers of the limbs, whether purely traumatic in origin, representing the unhealed remnant of an originally large tissue loss whether the result of a lowered vitality of the skin of the limb as a whole is in varicose veins or whether tuberculous in nature as in Bazin s disease, have always been the despair of surgeons Not only is the obtaining of complete healing a long, tedious and uncertain process but when at last they are healed, relapse with recurrence of the ulceration follows sooner or later in many cases

Failure of spontaneous healing of chronic ulcers is surely in large part at least, if not principally, due to the existence around the periphery and in their base of a thick layer of dense scar tissue the product of the long-drawn-out inflammatory reaction that represents the effort of the tissues to repair the defect The cicatricial contraction of this scar tissue has led to a progressive increase in its density with a corresponding decrease in its vascularity and so has resulted in a reduction of the blood-supply to the granulation tissue and epithelial cells seeking by their proliferation to repair the still-existing gap Such interference with the only source of nutrition that these cells possess must limit their active proliferation must in some cases even render them incapable of resisting the action of the germs still present and active on the surface of the wound, and so must bring to a standstill the tissues effort at complete repair Thus it would seem to be true that healing of the last part of the wound is prevented by the premature cicatrization of the part already healed Such seems to the writer the pathological explanation of the chronicity of these lesions

Under such circumstances what is required to bring about healing is some form of surgical interference that will in the first place remove this obstructing layer of accumulated scar, and, in the second, import into the gap so made a flap of normal healthy skin possessing a temporary independent blood-supply of its own so that when the flap has taken has adhered to the granulating surface, and its pedicle has been cut, the skin defect will be completely made good and the ulcer healed in a stable manner This means, then, the transplantation on to the freshly granulating surface of a flap of healthy skin of normal thickness, a flap which will ultimately derive its blood-supply, not precariously through a layer of dense contracting scar tissue, but from a healthy vascular granulating surface This constitutes the ideal form of the healing of these ulcers, the grafting of normal healthy skin on to the freshly excised surface of the ulcer, with the development of a minimum amount of scar tissue between the skin surface and the subjacent healthy tissues

The writer considers that this method of treating varicose ulcers (*Figs* 338, 339) will give results infinitely superior in certainty rapidity, and stability of healing to those obtained by any other method that has so far been used

The writer considers that *this ideal pathological termination—full thickness of normal skin covering healthy vascular tissue with an absolute minimum of scar tissue between—can in many cases be realized only by means of the tubed pedicled skin graft*, and that the results obtained by this method warrant its being regarded as in many cases the method of choice, the method that gives promise of the most certain and stable healing This method ensures the filling in of the tissue gap left after preliminary excision of the unhealed ulcer by flaps of skin brought in from a distance—for example, from the opposite limb, from another segment of the same limb, or from the front of the chest or abdomen By this method a large area of healthy skin can be imported to the place where it is required and kept with an independent blood-supply of its own for as long as may be necessary for it to unite with its new bed Moreover, the flap can be chosen from a part where there exists so great a redundance of skin as to allow of the complete closure of the defect resulting from cutting the flap and its pedicle, either by immediate aseptic suture or by suture assisted by a small amount of aseptic Wolfe grafting
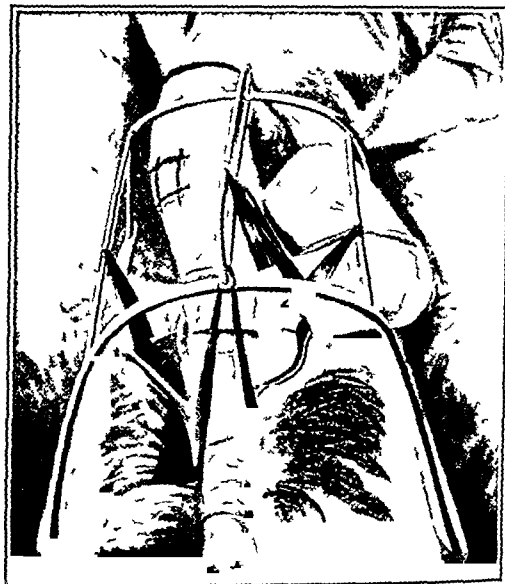
FIG 338 —Photograph of a sketch of the second stage in the treatment of a chronic ulcer of the lower part of the leg in ulcer that had persisted unhealed for over a year after a compound fracture of the tibia and fibula The first stage of the treatment consisted in the formation of a skin tube along the outer aspect of the thigh of the opposite side just above the knee At the second operation the upper end of the tube was cut opened out and sutured to the ulcer so as to fill the defect completely The two limbs were immobilized in the position shown For final result see Fig 333

FIG 3 —Final result of the case shown in Fig The chronic ulcer is completely healed by the large area of imported skin shown The discoloration round the imported flap is due to iodine staining

The advantages of this method may be summarized —

1 The graft is taken from a place where it can be easily spared

2 A far larger graft can be cut, transplanted, and maintained alive than any simple pedicled graft obtained locally

3 Such a graft possesses through its tubed pedicle an independent blood-supply that can be maintained over an almost indefinite surface

4 The gap left by cutting the flap and its pedicle can be closed aseptically and its healing completed before this area is approximated or in any way connected with the infected discharging surface on to which the flap is to be grafted

FIG 334

FIG 335

FIG 334 —This shows on the left leg two chronic ulcers of many months duration situated over and adherent to the internal surface of the tibia on the right leg is formed the tube which contains the internal saphenous vein the middle part of the gap left after cutting the tube has been closed by suture with buttons to assist in healing the tension and in addition many tension cut have been made through the skin on either side of the suture line in order to decrease the tension The gaps left at either end have been closed by Wolfe grafts, presuture on which a being maintained by gauze pad

FIG 335 —The next stage a fortnight later The two ulcers have been excised and the upper end of the tube detached opened out and placed on to the inner half of the ulcer The two limbs immobilized as shown in plaster of Paris side by side Three weeks in this position was sufficient for the grafted end to gain a blood supply sufficient to nourish the whole tube (See Fig 336)

5 The length of the tubed pedicle allows the distance between the source of the transplant and its new bed to be sufficient to make the position of retention of the limb as comfortable as possible for the patient and much more tolerable than if the two parts of the limb were to be closely approximated

6 The final pathological result approaches most nearly to the ideal one formulated above

This method of importing flaps of full thickness of healthy tissue is very useful in replacing, by such normal skin, areas of scar skin and scar tissue which in the neighbourhood of joints are producing a deformity or are causing a limitation of the range of movement Especially is it to be used in contractions of the fingers and hand after burns septic infections, etc

The Technique of the Tube-pedicled Method of Skin Implantation as adapted to the Treatment of Chronic Ulcers of the Limbs —The essential steps in the carrying out of the skin transplantation are as follows —

1   The formation of the skin flap with its tubed pedicle

2   The preparation of the surface of the ulcer for the reception of the flap

3   The implantation of the skin flap, connected through its pedicle with an independent source of blood-supply

4   The maintaining of close contact between the under surface of the flap and the granulating surface of the ulcer until they unite by secondary adhesion of their granulating surfaces

FIG 336

FIG 337

FIG 336 —The last stage both ends of as much of the tube as was required have now been transplanted on to and have adhered to different parts of the ulcer   The edges still require trimming and suturing and the redundant tissue need to be cut away (see Fig 337)

FIG 337 —The final stage of the case the earlier stages of which are shown in Figs 334 and 3 6

5   The division of the pedicle and the close adaptation of skin flap to the edges of the ulcer, so that as small an area as possible of raw surface is left to become covered with thin epithelial 'skin scar

The duration of the whole process varies in different cases , in the simplest the transplantation takes about six weeks to accomplish, and requires the performance of at least three separate operative stages, each of which is preceded and followed by a period of preparation and waiting   More difficult cases take about three months, and the number of operations that will be required may be as many as six or eight—none of them of course being severe

The First Pre operati e Period —It is important that the ulcer and the surrounding skin should be in as healthy a condition as possible before attempting the first stages in the skin transplanting , with this end in view the wound should be treated on general surgical lines with antiseptics ointments, etc , in order to reduce to a minimum bacterial activity and inflammation in and around the ulcer , it is also important that the surface

should be made as dry as possible, to effect this nothing seems to equal the daily expo-
sure of the wound to the sunlight

Before the first operation is attempted its details should be carefully worked out
and rehearsed The site from which it is proposed to obtain the transplant has to be
carefully chosen, and the direction and length of the flap and its pedicle determined

In most cases the writer has made use of the following sites —

1 For ulcers of the foot or about the ankle, the skin of the opposite thigh or the skin
of the buttock of the same side

2 For ulcers about the calf and knee, the skin of the inner side of the opposite leg
about the same level

3 For ulcers of the thigh, the skin of the inner side of the opposite thigh

4 For ulcers of the upper limb the skin of the front of the chest or abdomen

As regards the direction of the tubed pedicle,
where this is to be cut from the skin of the inner
side of the leg or thigh the writer has found
it advantageous to include in the pedicle the

FIG 338

FIG 339

FIG 338 — The second stage in the grafting of a chronic varicose ulcer of the leg of three years standing The ulcer
had been excised and a large skin tube formed on the buttock of the same side three weeks before at the first operation
At this second operation one end of this tube had been cut and transplanted on to the upper half of this excised ulcer the
limb being then immobilized in the position shown for a month when the other end of the tube was detached from the
buttock opened out and grafted on to the still unhealed lower half of the ulcer Note that the dark colour is due to
painting with iodine solution and not to circulatory change in the tube and flap For final result see Fig 339

FIG 339 — The final stage of healing of the
and suturing of contiguous edges This has
has shown that in time the imported flap subst

of the redundant part of the tube
in place of the ulcer experience
as the rest of the skin of the limb

internal saphenous vein, elsewhere one must be guided by the known anatomical facts
regarding the blood-supply of the skin An excellent account of this subject, worked
out for the needs of plastic surgery, was given in an article by Pieri in *La Chirurgia
degli Organi di Movimento*, 1918, vol ii, Fasc 2, April As regards the length, this
must be calculated beforehand with the limb fixed in the intended position

The First Operation —This includes (1) *An aseptic stage*, and (2) *A septic stage*

1 *The Aseptic Stage* —This consists of the cutting of a long flap of skin of the deter-
mined length and direction, and its tubulization The gap left after this step has been
taken must now be closed Except for a triangular piece at each end where the flap
widens out, this can be done almost always by undercutting and suturing with tension
sutures The two triangular raw areas should be grafted with Wolfe grafts, which are
sewn in place and kept pressed down on to their beds by means of pads of gauze placed
between them and the attached ends of the tube

2 *The Septic Stage* —The surgeon then proceeds to the complete excision of the

ulcer and its surrounding mass of scar tissue, including the circumference of thin epithelial skin scar

First period of post operative treatment—During this period of fourteen days the excised surface that now represents the ulcer should be daily dressed and kept as clean and dry as possible

For twenty-four hours previous to the next operation a tight ligature should be tied so as to strangulate the blood-supply through that end of the skin tube which it is intended to sever on the morrow   This renders the tube dependent on one source of blood-supply, that from the other end only   It also serves to test whether the tube has as yet a sufficiently rich blood-supply to survive this reduction in the number of its sources , if after an hour or two part of the tube looks pale and becomes cold, then the ligature can be removed and the next operative stage postponed until such time as this ligature test proves satisfactorily that it is safe to cut off the blood-supply from this end

The Second Operation —

1 The tube should be cut through at the point where it was ligatured , the blood flow through the tube should now be examined , should the cut edge of the tube continue to ooze then it is likely to survive , in the rare cases in which it simply becomes pale and

does not ooze it will be wise to postpone opening it out and fixing it to the surface of the ulcer for a day or two, to test its viability

2 The free end of the tube is now opened out but only a sufficient area to furnish a good broad surface for apposition and adhesion to the granulating surface of the ulcer , unless the ulcer is a small one there need be no attempt at this stage to fill the defect completely with the imported skin , the free edges of this part of the flap are then sutured to the contiguous edges of the ulcer and the two surfaces maintained in contact by means of firm pressure by a pad and bandage

Fig   340 —The first stage in a case of importing skin from the chest by means of the tubed pedicled flap to replace the chronic ulcer surrounded by scar on the dorsum of the hand   The second stage will be similar to that shown in *Fig* 3 0

3 The limb or limbs must now be immobilized in the required position—usually by plaster of-Paris—so that no involuntary movement of the patient may detach the flap from contact with the surface to which it is being grafted   It is essential, wherever one limb or segment of a limb is superimposed upon another, that the one should not rest actually in contact with the other , otherwise a pressure sore will inevitably result

Second period of post-operative treatment—The most important indication for treatment now is the maintenance by pressure of absolute contact between the two surfaces the deep surface of the flap and the surface of the ulcer , the sooner union has been obtained between them, the shorter will be the period of fixation in a not too comfortable position for the patient and the sooner will it be possible to divide the pedicle and proceed to the utilization of the pedicle itself for the covering in of the rest of the ulcerated surface

When it is considered that the time has come for the division of the pedicle, and that the tube has now a sufficient blood-supply from its union with the ulcer, it can be put through a ligature test similar to that described above for the twenty four hours preceding the next operation

The Third Operation—The pedicle is divided and the limbs are freed from the retention apparatus; the cut end of the pedicle should now bleed quite freely and continue so to bleed; otherwise it will be well to wait a few days before opening out an inch or two of this end of the tube and implanting it on another part of the surface of the ulcer and suturing it into position and exerting pressure on it exactly as was done in the case of the first piece transplanted

The third period of post-operative treatment—The pressure on this part of the flap is maintained in the same way until it, too, is firmly united in position; the imported tube should now somewhat resemble the handle of a Gladstone bag, the two broad flat ends adherent to the ulcer united by the still tubulized middle portion of the pedicle

The Fourth Operation—This consists in adapting this central part of the tubulized skin-flap to whatever surface of the ulcer is still raw and uncovered by imported tissue the redundant parts are trimmed away

The fourth post-operative period is concerned with the maintaining in apposition such of these parts as have still to unite with the ulcer

EPONYMS

III BRODIE'S TUMOUR, AND BRODIE'S ABSCESS

Sir Benjamin Brodie resigned the office of Surgeon to St George's Hospital in January 1840 at the age of 57, after thirty-two years' service as Assistant Surgeon and Surgeon He says that for a long time after his resignation he never passed the hospital without a sense of regret that his work there was over   and to mitigate this feeling he delivered annually a short course of lectures to the students in the winter session " generally selecting for his subject some one class of disease and giving a more detailed history of his own experience than was possible in an ordinary course of surgical lectures   They were in fact, the origin of the clinical lecture which is now so familiar in the medical curriculum   Of these lectures Sir Henry Acland says   ' None who heard him can forget the graphic yet artless manner in which, sitting at his ease he used to describe minutely what he had himself seen and done under circumstances of difficulty, and what, under like circumstances, he would again do or would avoid   His instructions were illustrated by the valuable pathological dissections which during many years he had amassed, and which he gave during his lifetime to the hospital

Brodie's Tumour of the Breast, and Brodie's Chronic Abscess of Bone—the two conditions which have perpetuated his name in the literature of surgery – were the subjects of lectures delivered in this manner   Those dealing with the first condition are reported in the *Medical Times* for 1844, vol x pp 163 and 191 being the eighth and ninth lectures of the course

After some preliminary remarks Sir Benjamin Brodie said — In the present lecture I shall make some observations on the diseases of the breast, no very clear description having been given of them, although of common occurrence   The disease to which I shall particularly refer to-day is one of considerable interest , especially so because it is quite different from carcinoma with which it has been frequently confounded   It is not met with in hospital practice but very often shews itself in private life and unless I had had the advantage of seeing a large number of private patients, I should not have been able to make out its symptoms and history, as I believe I now can   A lady consulted me who had one of these tumours in her breast, about the size of a walnut , I punctured it with a needle first, and finding it contained serum, I laid it open with a lancet , a large quantity of fluid escaped   I then dressed it with lint to the bottom, meaning to bring on inflammation   a good deal of suppuration followed, and the wound was two months before it healed and then the disease was apparently quite eradicated   About a year after this the patient came to me again, and I found, where I had opened the cyst a fungous tumour as large as the cyst I had previously opened   I recommended her to have the breast amputated , the operation was performed, and we found it (*Fig* 341) to be entirely made up of cysts containing fluid matter, and one of a large size as represented in the drawing on the table   From the inner surface of this cyst there projected a solid tumour, which appeared to be made up of numerous folds giving it a plicated appearance covered by membranes continuous with that lining the cyst , and when cut into, it looked like very slightly organized fibrine   Very many years ago I had the opportunity of witnessing a similar operation performed by Mr Freeman of Spring Gardens   and in my written notes of this case I find I described it as looking like slightly organized fibrine In this instance the tumour occupied one third of the cavity of the cyst   But this is not

the only situation in which these solid masses are formed you will sometimes find them outside the cyst and these will increase in size till all appear to be united in one solid mass, but if you carefully examine them in this state you will find them outside, and perfectly distinct from, the inner surface of the cyst Here is another tumour (*Fig 312*) which I removed from a private patient, it is of a similar character and the breast in this instance weighed between seven and eight pounds On cutting into it a cavity was found holding a large quantity of serum I said in this particular instance the breast weighed upwards of seven pounds and I have seen other cases where they have attained a similar magnitude The skin does not always ulcerate in these cases but occasionally it is so distended that it bursts, a large quantity of fluid matter will be discharged, and an ulcer of an unhealthy character will be left, which, if not speedily removed, will wear out the constitution and destroy the life of the patient The disease is I have said before, is not cancerous, but still it should be removed because if allowed to remain the local irritation will destroy the life of the patient and if removed it will not return If you operate it at all you must remove the whole of the breast for it is no use taking away small portions It is better to perform the operation
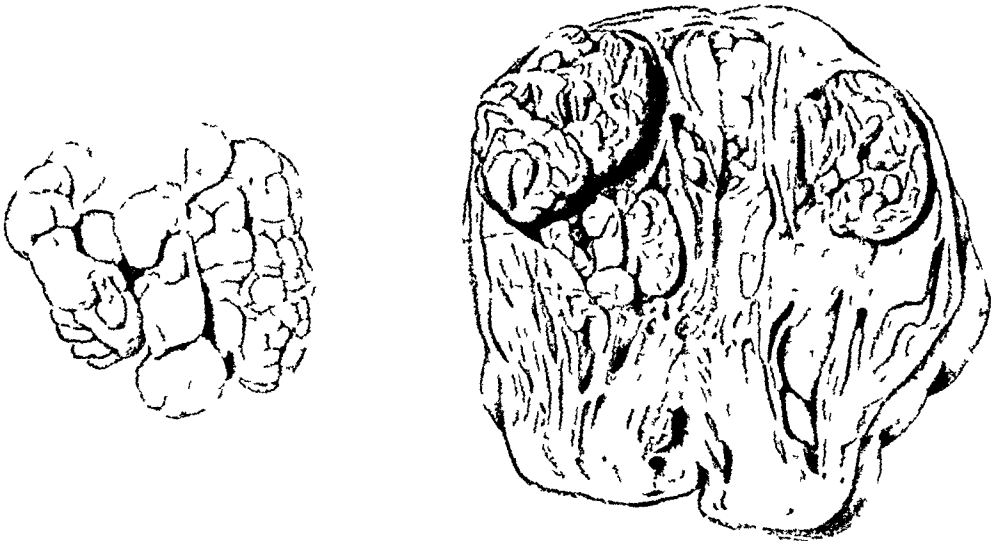
Fig 312 —Brodie's tumour copied by permission from the drawing in St George's Hospital

whilst the tumour is small, nevertheless you are not to be detained by its magnitude because it is not in this disease as in carcinoma, there is, in fact, no danger and I have seen a great many cases where the operation has been performed and the disease has never returned I have given no name to this affection because I think it is an error of modern times to be continually giving new names to diseases but if it must have a name I think it should be called sero cystic tumour

Sir Benjamin Brodie s lecture on Abscess of the Tibia was delivered in the Theatre of St George's Hospital on November 19 1845 It is reported in *The London Medical Gazette* for 1845 vol xxxvi (New Series vol 1) page 1399 He said — 'In the year 1824, I was consulted by a young man 24 years of age, under the following circumstances There was a considerable enlargement of the lower end of the tibia, but the ankle-joint admitted of every motion and was apparently sound The skin was thin, tense, and closely adherent to the periosteum There was constant pain in the part, generally of a moderate character, but every now and then it became excruciating, keeping the patient awake at night and confining him to the house for many successive days It made his life miserable and his nervous system irritable one effect of which was that it spoiled his temper

and thus produced another set of symptoms in addition to those which were the direct consequences of the local malady The disease had been going on for twelve years He had consulted a number of surgeons respecting it, and had used a vast variety of remedies but had never derived benefit from anything that was done Instead of getting better, he every year became so much worse I tried some remedies without any advantage, and at last recommended that he should lose the limb Mr Travers saw him with me and agreed in this opinion Amputation was performed, and the amputated tibia is now on the table You will see (Fig 343) how much the lower end of it is enlarged, and that the surface of it presents marks of great vascularity The bone in the preparation is divided longitudinally and just above the articulating surface there is a cavity as large as a small chestnut This cavity was filled with dark-coloured pus The inner surface of it is smooth The bone immediately surrounding it is harder than natural The examination of the limb explained all the symptoms there was an abscess of the tibia, stretching the bone in which it was formed, or rather, if I may use the expression, trying to stretch it, and thus causing the violent pain which the patient suffered On observing these appearances, I could not help saying, that if we had known the real state of the disease

Fig 343 —Brodie's tumour — from the tumour of the breast (× ")
St George's Hospital Museum

the limb might have been saved A trephine would have made an opening in the tibia and have let out the matter It would have been merely applying the treatment here that we adopt in the case of abscess elsewhere You open a painful abscess of the arm with a lancet you cannot open an abscess of the bone with a lancet but you may do so with a trephine

' About two years after the occurrence of this case I was consulted by another patient 23 years of age, who had an enlargement of the upper end of the tibia extending to some distance below the knee He suffered a great deal of pain, the part was very tender and there were all the symptoms of chronic periostitis I made an incision over the part dividing everything down to the bone, and found the periosteum very much thickened There was a new deposit of bone under the periosteum, softer than the bone of original formation This operation as in other cases of chronic periostitis relieved the tension and the pain and the patient was supposed to be cured However about a year afterwards in August 1827 there was a recurrence of the pain, the enlargement of the tibia which had in some degree subsided, returned and it continued to increase In the enlarged tibia there was one spot a little below the knee where there was exceeding tenderness on

pressure I need not describe the symptoms more particularly it is sufficient to say that they bore a very close resemblance to those in the last case, the only difference being that, as the disease had been of shorter duration, the pain was less severe and that the tibia was affected in the upper instead of the lower extremity I concluded that there must be an abscess in the centre of the bone and applied the trephine to the tender spot I used the common trephine made for injuries of the head, which, having a projecting rim or shoulder, would only penetrate to a certain depth However, it enabled me to remove a piece of bone of sufficient thickness to expose the cancellous structure Then with a chisel I removed some more of the bone Presently there was a flow of pus in such quantity as completely to fill the opening made by the trephine and the chisel It seemed as if the bone had been, to a certain extent, kept on the stretch by the abscess and that, as soon as an opening was made into it, it contracted and forced up the matter The patient was well from that time, the wound healing very favourably, and he has never had any return of the disease

Sir Benjamin Brodie then gave details of similar cases which he had treated successfully by trephining, and proceeded to describe the method of arriving at a correct diagnosis In this respect he said " When the tibia is enlarged from a deposit of bone externally—when there is excessive pain, such as may be supposed to depend on extreme tension, the pain being aggravated at intervals, and these symptoms continue and become aggravated, not yielding to medicines or other treatment that may be had recourse to—then you may reasonably suspect the existence of abscess in the centre of the bone You are not to suppose that there is no abscess because the pain is not constant, on the contrary it very often comes on only at intervals, and in one of the cases which I have related there was, as I then mentioned, an actual intermission of seven or eight months After the disease has lasted a certain number of years indeed, the pain never entirely subsides but still it varies, and there are periods of abatement and of exacerbation '

As regards treatment, Sir Benjamin Brodie recommended the use of a small sized trephine without the rim or shoulder which was then common in the instruments used for trephining the skull The lecture ended with a consideration of the results which might follow upon a chronic abscess of bone left without operative treatment, and the narration of a case in which the trephining of a bone affected with chronic inflammation was followed by cure of the symptoms, although there was no abscess

The illustrations for this article are copied by the kind permission of the Committee of St George's Hospital from specimens in the Museum Fig 341 is from a contemporary drawing of *Specimen 7j* from the case related on page 334 in the Museum of St George's Hospital, labelled II 14 c This specimen which served as the text of Sir Benjamin Brodie's thirty one years after the amputation had been performed is being the actual specimen which led Sir Benjamin unnecessary in cases of chronic abscess of bone
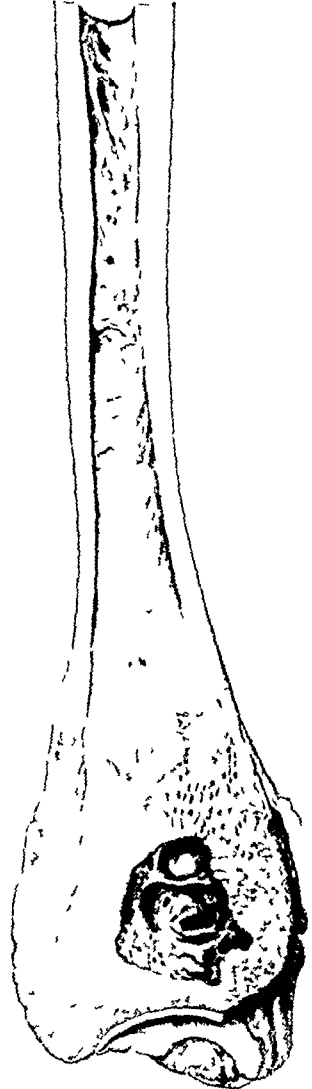
Fig 343 —Brodie s abscess Lower end of tibia
St George s Hospital Museum

Fig 343 is from a preparation It is almost certainly the specimen which served as the text of Sir Benjamin Brodie's classical lecture delivered It is of still further interest to decide that amputation was

A STUDY OF THE SURGICAL PATHOLOGY OF HYPERNEPHROMATA

WITH SPECIAL REFERENCE TO THEIR ORIGIN AND SYMPTOMATOLOGY

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This paper represents part of a research into the pathology of tumours arising in the renal cortex of man and animals   Owing to delays of various kinds in gathering the material, it is not possible to cover the whole ground in this communication, and hypernephromata are therefore considered separately

There are, in the museum of the Cancer Hospital, nineteen specimens of this type of tumour   Thirteen of them have complete clinical notes   Three of them died of some other disease and the hypernephroma was discovered accidentally at the post-mortem examination   The clinical notes of the remaining three are unavailable , the specimens were presented by surgeons outside the hospital and the cases cannot be traced

Sections were taken from various parts of the growth, and were stained with hæmatoxylin and eosin, and also iron hæmatoxylin and Van Gieson   These two stains were found after trial to be the best for general purposes   It is very important in investigating the structure of these tumours to cut sections from different parts of the growth, and not to examine merely one section taken for diagnostic purposes

ETIOLOGY

Analysis of the data gleaned from the nineteen cases reported at the end of this paper yields the following facts with regard to age, sex incidence and frequency

During the last fifteen years approximately 10,500 patients have been admitted to the hospital, most of them suffering from a tumour of some kind   Of this large number 6 presented themselves with hypernephroma , in taking this figure into consideration it must be borne in mind that one of the members of the surgical staff has a large genito urinary practice   These tumours, therefore, are not by any means common, although they make up the bulk of all growths arising in the kidney   Of 483 cases of renal tumour reported by various authors in Europe and America, 315 were proved to be hyperneph roma , thus making a percentage of 65

Three of the specimens described below were discovered accidentally at the routine post-mortem examination made on nearly all patients dying in hospital   They all died of cancer elsewhere, one in the rectum, one in the breast, and one in the tongue   This is extremely interesting when considered in relation to the infective theory of the disease, as it is to be expected that the kidney would react to the cancer infection in its own way, since it shows some reaction to all other infections, and is an important factor in the excretion of many of the organisms which gain entrance to the blood-stream   It shows a relative immunity to the presence of organisms in its substance provided its resistance is not lowered by any other agency   I have been unable to find hypernephromata accidentally discovered post mortem in patients dying of cancer in other hospitals Undue significance ought not to be attached to this coincidence, as most of the post-mortems done are on patients dying of cancer, and patients presenting themselves with hypernephroma do not have cancer elsewhere

There are fourteen cases in this series whose ages are recorded   The average age at which a diagnosis of hypernephroma was made is 55 years and 3 months   *Table I* shows the age incidence

The youngest case was 23 years old and the oldest 72   Two cases occurred in which, given the opportunity, a diagnosis might have been made before, and which materially affect the value of these figures   One gave a history of twenty years duration, and another appeared thirteen years after the occurrence of the first symptoms   In order to give a better idea of the age incidence 32 cases have been taken from the published reports of the Mayo Clinic,[1] and 28 from the surgical service of the Mount Sinai Hospital [2] making a total of 74 cases   These additional cases have also been used in computing other statistics where a larger number is required to attain to any degree of accuracy The modified list then appears as in *Table II*

Table I

Age	Cases
20 to 29	1
30 „ 39	–
40 „ 49	1
50 „ 59	7
60 „ 69	4
70 „ 79	1

Table II

Decade	Cases	Per cent
First decade	1	1 3
Second „	–	0
Third „	2	2 6
Fourth „	10	13 5
Fifth „	21	28 4
Sixth „	30	40
Seventh „	9	12 3
Eighth „	1	1 3

Of 15 cases here reported 10 were males and 5 were females   This proportion by no means represents the true state of affairs   All authorities agree that there is a slight preponderance in favour of males , and adding to these cases the same list taken from the literature that was employed previously, it will be found that out of 75 cases, 45, or 60 per cent, occurred in the male sex, and 30 cases, or 40 per cent, in the female

The tumour arose in the left kidney 13 times, and in the right kidney 4 times   Again this gives an entirely wrong impression of the facts, and adopting our previous method to put it right, we find that out of 77 cases, in 39 the tumour was on the right side, and in 38 on the left   In 1 case only was there a history of injury which it seemed might have something to do with the disease   Wilson,[3] in his 32 cases, found a similar history in 4

To sum up   Hypernephromata are about equally distributed as regards the side of the body on which they occur , males are affected slightly more often than females , and the large majority of cases occur between the ages of 50 and 60, although the disease has been seen in childhood [4]   They form 65 per cent of all renal tumours

SYMPTOMATOLOGY

The average length of time which elapsed between the appearance of the first symptom and operation was 3 years and 4 months   If, however, we deduct the two outside numbers to which reference has already been made, we get an average of 11 months The longest interval recorded in these notes is 20 years, and there is a possibility that perhaps the hæmaturia complained of was due to some other cause   In any case the disease had almost certainly been present for 2 years   Another patient had noticed the tumour for 13 years and had no other symptom   There is no doubt that many of these tumours grow very slowly   The literature on the subject contains several records of cases with a long history of hæmaturia   Examination of the specimens both macroscopically and microscopically sometimes reveals strands of compressed renal tissue, which at one time formed a false capsule for the growth   It is highly probable that if many of them were efficiently investigated when the first symptom appeared, the results of operation would be much improved   Some of the tumours, however, grow very rapidly, and those arising near the renal pelvis naturally give rise to symptoms at an earlier date   The shortest interval noticed was 5 weeks, and this occurred in two cases   In *Case* 1 the tumour probably grew very rapidly towards the end of its career   It is a large one, and

that part of the tumour which is in direct relationship to the kidney substance is not encapsulated In *Case* 12 there was a small tumour invading the pelvis This patient is at present alive and well

By far the commonest initial symptom is *hæmaturia* , it is said by various authorities to be the first sign of the disease in between 70 and 80 per cent of all cases In 11 out of these 13 cases it ushered in the disease Of the remaining 2, one first complained of a tumour, and never had hæmaturia at all The other first complained of malaise and temperature , there was a small amount of pus present in the urine, and the patient had nocturnal frequency Israel[8] states that the temperature may occur irrespective of infection and that it does so in more than half of the cases This proportion does not conform to the experience of others, but there is no doubt that patients suffering from hypernephromata and having an uninfected urinary tract do get rises of temperature This is perhaps due to the entrance into the blood-stream of small amounts of foreign proteins detached from the growth, and is anaphylactic in nature

The hæmaturia is of two kinds In some cases it is due to chronic interstitial nephritis caused by the pressure of the slowly advancing growth It is not very profuse in amount, and it is intimately mixed with the urine It is probably caused by venous congestion, pressure of the advancing growth blocking the smaller veins and leaving the lumen of the arteries intact Small hæmorrhages then take place into the adjacent tubes Blood in the renal tubules in the neighbourhood of the growth is a very common finding in sections in which the edge is included It is extremely probable that microscopic blood is present long before the patient notices anything wrong, and if patients were more observant, smoky urine would be a far commoner initial complaint It appears probable that the initial hæmaturia was of this type in 8 of the 13 cases It is obviously impossible to be sure *Case* 2 had had hæmaturia for five years, he also had chronic interstitial nephritis in both kidneys

The second type of hæmaturia is much more profuse and is also associated with the passage of clots and renal colic It is due to direct involvement of the pelvis by the growth, or to the invasion of one of the larger veins in the renal cortex It occurs at a later stage in the disease than the first type, and at some time or other is present in most cases Profuse hæmaturia is a serious factor in prognosis although not a bar to cure It should be the ideal in the treatment of this condition to remove the kidney before the renal pelvis is invaded

The next most common symptom is *pain* In some form or other it occurred in 8 of the 13 cases here reported, and for convenience of description may be divided into three types (1) Renal aching caused by distention of the pelvis, common to all renal conditions in which blockage of the outlet occurs , (2) Renal colic, associated with the passage of clots down the ureter and (3) Acute attacks of pain in the kidney, the result of a large hæmorrhage into the growth It is extremely difficult to generalize accurately from a small number of cases , but careful study of the specimens removed at operation, in comparison with the symptoms, fails to establish any definite relationship between the position and size of the growth, and the pain complained of For instance, in *Case* 4 the growth was large, and adherent posteriorly , the renal pelvis appeared to be part of the growth, and what remained of the kidney tissue was separated from it by the tumour That is to say, the secretion of the renal tubules was practically non existent and had been unable to get to the pelvis for a long time The patient complained only of backache, a very common symptom in her sex, and quite possibly not due to the tumour In *Case* 5 the growth was in the upper pole and there was no pain In 6 out of 8 growths arising in the middle and lower poles, renal aching was a marked symptom In 3 of the 4 growths which arose at the upper pole of the kidney there was no pain, and in the 1 case with the tumour in this situation in which renal aching was a feature, the pelvis contained much growth Emphasis has been laid on this point because it has been recently stated that growths at the upper pole of the kidney give rise to pain as an early symptom, owing to interference with the diaphragm

Colic in varying grades of severity occurred in 5 of the 13 cases Others had severe

pain which was probably due to the passage of blood down the ureter, but it did not amount to true colic One gains the impression that colic caused by the passage of clots down the ureter is neither so severe nor so frequent as in renal lithiasis The passage of large worm-like clots associated with colic raises a strong presumption of renal tumour

Retention and difficulty of micturition occurred four times in this series It is due to clots forming in the bladder after a profuse hæmorrhage It rarely gives rise to any serious difficulty, and is relieved by the passage of the offending clot

Frequency of micturition was twice mentioned In one case it was slight, and probably due to an enlarged prostate, and in another case the patient had to get up three times it night to pass water This was associated with a urinary infection The association of calculi and tumour in the same kidney and concomitant infection has been reported by several workers Stones occur fairly frequently in connection with growths arising in the renal pelvis, but not often with hypernephromata

A tumour was palpable in 10 out of the 13 cases In one case it was the only complaint As most of the growths in this series were on the left side, it appears that a renal tumour is frequently felt A left-sided varicocele which does not disappear when the patient lies down is stated in all text-books to be a symptom of new growth in the kidney As far as one can find out from these cases and from the literature, it is very seldom seen, and when it does occur there is extensive invasion of the renal vein

DIAGNOSIS

Cystoscopy is of the greatest value It rarely reveals any abnormality in the bladder, but blood can be seen coming from the affected kidney if the examination is made during an attack This procedure is often absolutely necessary in order to distinguish between a renal and a vesical growth, the early symptoms of the two being often identical It may also be possible to make a differential diagnosis between a tumour arising in the cortex of the kidney and a papilloma of the pelvis Profuse hæmaturia and colic are characteristic of both conditions, but in the latter small buds of growth can sometimes be seen pushing their way out of the corresponding ureteric orifices and implantation may even be present in the bladder itself It should always be done where possible, as in many cases it is the only way to localize the disease A small worm-like clot may be seen protruding from one or other ureter As far as I can make out, the ureteric orifice on the side of the tumour shows no changes characteristic of the disease During cystoscopy the opportunity should be taken to estimate the function of the opposite kidney, by comparing the percentage urea in its secretion with that of the blood In *Case* 1 this was not done Reliance was placed on the fact that the patient had a good urea output from his other kidney If his blood urea had been estimated, it would probably have been raised and have given some indication of his chronic interstitial nephritis This patient died of uræmia

We have found that the indigo carmine test, in addition to the urea test, is one of the most useful for estimating the function of a single kidney Two c c of a 0 4 per cent solution of indigo carmine is injected into a vein It should appear from the ureteric orifice of a normal kidney within ten minutes of the injection It is important when carrying out this test that the patient should not be anæsthetized An anæsthetic or the presence of catheters in the ureter temporarily suspends or at any rate modifies the rate of renal secretion I have several times noticed in doing indigo carmine tests that the dye has not appeared in the urine until the patient has come out of the anæsthetic Immediately the patient began to come round it appeared, and although in one anæsthetized case three quarters of an hour elapsed between the injection and its appearance in the urine, the kidney was afterwards proved to be capable of normal function In unanæsthetized patients this test is fairly reliable If an anæsthetic is necessary for cystoscopy, parasacral anæsthesia is the best method when functional tests are contemplated The secret of its success lies in the injection of a large quantity, 30 to 40 c c, of dilute novocain slowly into the extra-dural space In *Case* 13 it was a diminution in the secretion of

indigo carmine that led to the exploration of the kidney   In this case the urea concentration test was quite normal   This latter test does not give any information as to whether a single kidney is damaged or not, it merely gives the combined output of both kidneys   The output of the diseased kidney is often lowered, depending on the amount of renal tissue left and the degree of blocking   On the other hand, it may show no abnormality

Pyelograms taken after the injection into the renal pelvis of 25 per cent sodium bromide solution would probably give some information as to the deformity of the pelvic outline caused by the growth   It has not been done in these cases, and is rarely necessary, as by the time the pelvis is invaded other unequivocal symptoms are usually present

In this series x rays were taken only in those cases in which it was necessary to exclude stone   This happened in 6 cases, and in 4 of them either enlargement of the kidney or an opaque area in the kidney region was seen, in 2 of these four cases no tumour was felt, and so the finding was distinctly useful   The improvement in radiological technique, brought about by high-power tubes, has enabled us to get a negative showing a clear shadow of the kidney outline in a large proportion of all cases   I think that a far wider field of usefulness in renal surgery is being opened up than the mere differentiation of intra- and extra-renal shadows   At the Cancer Hospital the equipment is such that good photographs can be taken of a motionless kidney while the patient holds his breath

In regard to differential diagnosis, the chief difficulty is to distinguish between chronic interstitial nephritis beginning in one kidney and a renal neoplasm in an early stage   There is no doubt that the former may give rise to fairly profuse unilateral hæmaturia and at the same time give rise to renal pain   Essential renal hæmaturia produces the same effect, and is due to a collection of varicose veins situated at the apex of the pyramids   Incidentally these are stated by Payne and his co-workers[9] to be the result of chronic interstitial nephritis   It may sometimes be necessary and justifiable to explore the kidney in order to determine the presence or absence of growth   I have recently seen two cases of unilateral renal tumour and hæmaturia in which a diagnosis of hyper nephroma was made   At operation they were both found to have multilocular cystic disease   Other conditions producing hæmaturia are usually susceptible of diagnosis by ordinary methods, if not, exploration is necessary for their cure

TREATMENT

The results of the treatment of hypernephromata are not very encouraging   Their great vascularity and their tendency to invade the renal vein make dissemination by the blood-stream a not infrequent happening

Of these 13 cases, 2 cannot be traced   One of them (Case 10) is very unlikely to have escaped recurrence judging by the pathological findings   A large mass of growth was seen during operation at the junction of the renal vein and the vena cava, and it has therefore been classed as a recurrence   As the results of operation there were 2 deaths, one from uremia (Case 1) and the other (Case 4) from post-operative pneumonia   No secondary deposits were found post mortem

Two cases recurred locally within six months of operation (Cases 9 and 11)   In both the capsule was invaded, the latter case somewhat extensively   One case died of recurrence in the abdomen and lung (Case 5), and the one already mentioned almost certainly recurred   Of the remaining 6, 1 (Case 3) died five years afterwards of cerebral embolism, there was no clinical evidence of any recurrence   Two (Cases 7 and 8) were alive and well nine and seven years respectively after operation   These two may be fairly classed as cures although Case 8 died of pneumonia   Cases 6 and 12 were alive and well three and two years respectively after operation   The last case (Case 13) was operated on too recently to be of any use for statistical purposes

A study of the growth and microscopic pathology of these tumours raises hopes that local recurrence may be prevented by a more thorough removal of the perirenal fat   It is impossible to say how thoroughly this was done in these cases owing to the insufficiency

of all the operation records None of the specimens show really extensive extra-renal infiltration such as is seen in other types of carcinoma The appearances suggest that pressure, often caused by a recent subcapsular hæmorrhage, is the cause of the capsule giving way rather than that the growth is eating into the surrounding tissue Microscopical examination demonstrates that even when the growth has invaded the capsule the fat is not usually widely infiltrated

In most of these cases the kidney was removed by the lumbar route, and from the point of view of facility there is very little advantage to be gained from an abdominal approach On the other hand, theoretical considerations would indicate that the renal vein should be ligated before any manipulation of the tumour is undertaken for fear of dislodging any growth it may contain, but from a practical point of view, if there is any growth in the vein, even should it be possible to remove it by ligature close to the vena cava, it is almost certain that particles have already been detached and have entered the general circulation In this series none of those cases in which the vein was invaded have been proved to have survived more than six months There were 4 cases out of the 19 in which the vein was invaded This is a lower percentage than the figures given by the Mayo Clinic Out of their 32 cases, in 16 there was invasion of the renal vein, 10 of these recurred, and the rest either died as a result of the operation, or less than six months had elapsed between the operation and the report It appears, therefore, that invasion of the renal vein which is appreciable to the naked eye makes the prognosis extremely grave, and almost hopeless Shock is an important consideration in operations on the kidney It is minimized by the use of a curved oblique lumbar incision, prolonged upwards behind so that the external arcuate ligament may be divided, and downwards in front as far as the anterior superior spine and a little mesial to it If at the same time the quadratus lumborum is nicked transversely, all the space required can be obtained for the removal of the largest tumour

It should be borne in mind that adhesions between the kidney capsule and the surrounding fat do not necessarily mean extension beyond the boundaries of the organ The abdominal route is indicated when there are doubts as to the upward limits of the growths, perhaps in the very largest tumours

SURGICAL PATHOLOGY

Gross Pathology—Hypernephromata have been shown in the part of this paper which deals with their etiology to occur in both sexes and at all ages, they also are found in all parts of the kidney and are not merely confined to one or other pole In this series of cases 6 arose in the upper pole, 5 in the lower pole, and 7 in the middle In 1 it was impossible to say in which situation the growth arose They are not as a rule difficult to distinguish from other renal tumours with the naked eye, for they have several outstanding characteristics —

1 They are nearly always more or less surrounded by a false capsule, composed of compressed renal tissue Very often this capsule appears complete, but in other cases it is interrupted at some point in its circumference and the tumour appears to be directly invading the kidney substance When this occurs to any marked degree, it is found on microscopical examination that the tumour is rapidly growing, and has, as a rule, taken on the more obvious character of a carcinoma Cases 1, 5, and 8 show this well In no case is the capsule a true one, it only consists of stretched and compressed renal tubules

2 It is common in fresh specimens to see yellow areas of varying size scattered all over the growth The yellow colour is not due to chromaffin substance, but to fatty degeneration

3 Hæmorrhage and necrosis are very common The hæmorrhage may take place in large masses or it may form the large bulk of the tumour It can be seen in all stages of organization, from fresh blood to the laminated organized clot found in some aneurysms In some specimens in which large hæmorrhages are absent, small patches of blood are to be seen In these cases it is interesting to note that the small hæmorrhages are

contiguous to one or other of the fibrous strands which always traverse the tumour, and they appear to arise from the invasion of a larger vessel contained therein It is to be expected that a good deal of bleeding would take place into the substance of a growth as vascular as a hypernephroma Necrosis is also common, and in some of the cases the centre of the growth has entirely disintegrated, leaving a thin layer of tumour substance surrounding a cyst whose edges are shreddy and necrotic *Case* 15 is an excellent example of this Necrosis, though not always visible to the naked eye, is a constant finding in sections

In addition to these features, which when they are at all marked usually settle the diagnosis, there are some other points which call for comment The size of the growths varies a great deal They may either be as small as a marble or as large as a fœtal head They are roughly spherical in outline, and when, as often occurs, they project from the fibrous capsule of the kidney, they have a bossed appearance

Their relation to the renal capsule and to the pelvis is of great interest, as it gives some indication of their nature The capsule is at first distended by the growth, and to this distention it reacts by increasing its thickness If the distention is rapid, the capsule becomes thin, and finally gives way at its weakest point The giving way is sometimes determined by a subcapsular hæmorrhage *Case* 1 is a good example of this On the posterior aspect of the specimen there is a large irregular split in the capsule, and through it one can see a mass of blood-clot In *Case* 6 this is apparently just about to happen Thinning of the capsule seems to depend less on the size of the growth than on the rapidity with which its bulk increases in *Case* 4, one of the largest growths in the series, the capsule was as thick and smooth as a sheet of normal dura In *Case* 3, which showed invasion of the capsule by growth, it had a smooth outline, was rather lobulated, and looked as though the perirenal fat had come away from its surface without any tight adhesion In 8 of the 19 specimens examined the capsule was invaded It should be noted that the fibrous capsule of the kidney is often adherent to the surrounding fat without any actual invasion having taken place

Invasion of the renal pelvis appears to take place in somewhat the same way, although the fact is not so easily demonstrated In *Case* 3, the pelvis, as well as being invaded, is also considerably distorted Invasion of the pelvis was noticed in greater or less degree in 14 out of the 19 cases It is, of course, the proximity of the growth to the renal pelvis which, as a rule, gives rise to the symptoms which alarm the patient Invasion of the renal vein was demonstrable to the naked eye in 4 cases , its significance has been already dealt with

Inspection of the cut surface of the tumour raises another point of interest It has been stated by various authors that remnants of a capsule which functioned when the tumour was smaller, and was later incorporated in its substance, is a fairly common occurrence Of course, observations made on a small number of cases are liable to much inaccuracy, but this appearance has not been found to be at all common in these speci mens In only 1 case was it noted as present In tumours which showed highly malignant characteristics some renal tissue was seen, but not in the more slowly-growing types

Fibrous trabeculæ running in various directions throughout the tumour were nearly always noted , in many cases they seemed to have undergone hyaline degenera tion, and this was confirmed by the section they divide the tumour up into segments, usually rounded, and from the thicker strands branches ramify throughout the whole structure Thus the characteristic lobulated appearance is produced The growth in undegenerated areas looks like a section through a gland These strands of fibrous tissue bear the blood-supply to the tumour-cells The masses of growth are sometimes arranged in rounded columns, which in sections seemed to be isolated from each other

Microscopical Appearances—A detailed study of many sections reveals the fact that these tumours are essentially papillary in structure Their appearance varies very greatly with the direction in which the sections are cut and the way the stroma runs The cells of what we may temporarily call the typical hypernephroma are large Their

protoplasm is vacuolated, and often contains a highly-refracting fatty material   In places where the vacuoles are absent, it is granular   Many of the cells show a spongy formation in their substance   This is more obvious where degeneration is beginning, and can be easily made out in those cells which are furthest away from their basement membrane   The nuclei are well marked and stain readily with logwood in its various forms   Under the high power, it can be seen that they contain chromatin granules lying in a clear substance   A large nucleus is frequently present, and active mitosis is a fairly constant feature   The size of the nucleus varies greatly, as does its regularity of outline, and the impression is gained that in the more malignant form the nucleus is correspond-ingly more irregular in outline   The appearance and shape of the cells vary a great deal

In some sections showing a regular alveolar arrangement, there is abso-lutely no vacuolation   These cells, which are close to their basement membrane, are usually cuboidal in shape, and the further they get away from it the more irregular is their out-line, the outer layers of cells being club shaped or amœboid

The connective tissue stroma is very often so thin that the cells appear to be growing from the endothelial wall of the capillaries, but in some cases they are surrounded by fine fibrils of areolar tissue, which is sometimes so thick that the capillaries it contains show up as small spaces in its sub-stance   It is the arrangement of this stroma and the plane in which the sections are cut that gives to hyper-nephromata their characteristic appear-ance

The forms that one sees in sec-tions fall into several broad types   The simplest has been termed in the case-descriptions the ' transverse peri-vascular arrangement ' (*Fig   344*)   This form has been brought about by cutting the section at right angles to the long axis of the vessels   There-fore, in the centre of the formation one sees the lumen of the capillary, often

FIG   344 —*Case 1   Section showing the perivascular arrangement in the connective tissue stroma*

containing blood corpuscles   Its endothelial lining is often easily distinguished   The capillary is usually surrounded by a thin layer of areolar tissue, which may, however, be absent   The tumour cells grow from its outer surface in rings   The cells are several layers thick, it first regular in shape   but increasingly irregular and larger as they get towards the periphery   It is in this formation that the giant cells are best seen   They occur at the periphery, and are in many cases continuous with the outer layer of cells   They consist of a large mass of protoplasm, which usually stains well   Their outline is very irregular, and they are a little larger than the common giant cells seen in tuberculosis   They are multinucleated, the nuclei being distributed throughout their substance , they stain well, usually more deeply than the ordinary hypernephroma cells   A careful study of these nuclei with the high power shows that they are not those of the polymorpho-nuclear leucocyte   Careful observation has been made of this, because Trotter[10] has stated that the multinucleated appearance is produced by the wandering into the cell of

polymorphonuclear leucocytes from outside   In these sections many giant cells have been observed with no leucocytes whatever in their vicinity   This formation is seen some where or other in almost every growth examined, and I think if more sections of each growth were taken it would be found constantly

Another form termed the 'longitudinal perivascular arrangement' is seen when the section is cut through the long axis of the capillary, the cells being arranged on either side This is best seen in sections in which the growth is not too tightly packed   When the cells are growing very rapidly, the capillary network is so compressed as to be invisible, and a mosaic appearance is thus produced   In the rapidly dividing parts of the growth the cells are smaller than usual, though they still have the characteristic vacuolation of hypernephromata

Now if the section is cut a little above or below the capillary, so as to go through the cells only and leave out the vessel lumen, the appearance which so resembles the cortex of the suprarenal body, and from which the tumour derives its name, is seen   It resembles the mosaic appearance referred to above, except that the cells are larger, and shaped more like suprarenal cells   This is not by any means the commonest form these tumours take and it is hard to see why it should have been responsible for their name

FIG 345 —*Case 2*   A loosely arranged example of the looped capillary type showing how the so called alveoli come to be   One vessel is also cut longitudinally

When the capillaries run in loops, and the loops are continuous, we get the formation which has been termed the 'looped capillary type' (*Fig* 345)   It is a very common one to meet, and at first sight gives the impression that we are dealing with an alveolar growth or adenoma   But in some of the sections, notably those of *Case* 7, its true origin is made clear   The transverse perivascular form is seen, but from the side of the central capillary a branch arises and begins to form its loop   In sections loosely arranged, the capillaries between the loops can be clearly seen   In most sections showing this type of formation a little gap is visible in the corners between the loops representing the vessel lumen   In other sections the loops are not quite complete, and a semipapillary appearance is pro duced   It is easy to understand that when these loops are small, the cells growing into the lumen and practically filling it up give the appearance of an adenoma   In other cases the loops are wide, and the connective tissue separating them is thick   When this occurs, the outer-layer cells growing into the lumen of the loop tend to degenerate, as they are a long way from their source of nourishment   Into these loops papillary proliferation often takes place   Papillary formation is often seen in the loop type when

rapid growth is going on   The cells are smaller than usual, often only one layer thick, and the loops, instead of being round, are square, thus we get a reticular appearance Papillary formation is seen somewhere or other in nearly every hypernephroma of which enough sections are cut, and I feel sure an adequate examination would demonstrate it in every case

The relation of the tumour cell to its stroma is one of the most important of its characteristics to be considered in deciding as to its nature, and enough has been said to demonstrate that, in all the varied appearances which are met in sections of these growths, the essential fact is that we have a series of cells whose tumour form may vary but whose relation to the stroma remains constant   The essentially papilliferous nature of hypernephromata is by no means a new conception   It was insisted upon by Stoerk,[11] but has been relegated to a back row among the factors to be considered by people who have put forward theories about tissue rests, a last resort which has been used at various times to explain the origin of every tumour whose etiology was doubtful
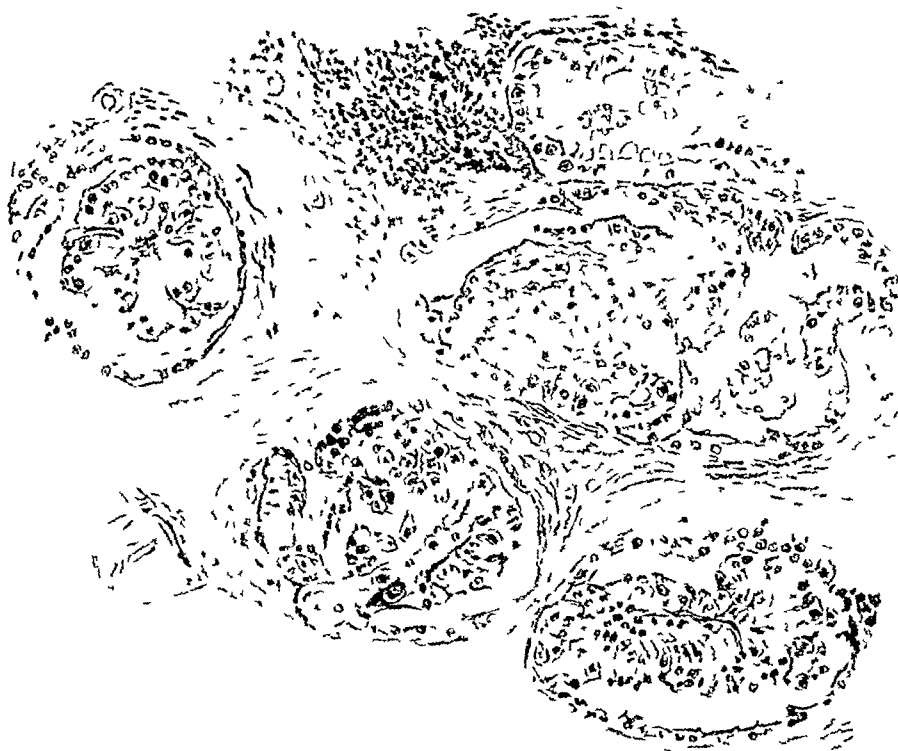
Fig 216 —Papillary growth commencing in the renal tubules   Hypernephroma and papillary carcinoma formations are present in other sections of the same growth

Their papillary structure is not, however, the only point which arises from a histological study of hypernephromata   Other workers have seen and described a gradual transition between the ordinary hypernephromata form and those of a carcinoma Appearances suggestive of sarcoma have also been noted, and are present in one of the sections of Case 2   Careful study of this section shows that we are only dealing with cells so malignant that they are single and isolated instead of being in masses   These aberrant cells are seen in sections of undoubted carcinoma in other parts of the body

The giant cells seen at the periphery of the transverse perivascular forms, and in the centre of the larger loops, are the first stage in the malignant change   Other sections show the typical appearance of a papillary carcinoma or adenoma, and it is only by cutting further blocks taken from the same growth that the forms characteristic of the so called

hypernephromata can be discovered It appears that the cells on the stalk, instead of being in one or two layers, grow in seven or eight, and in other parts of the same section the stalk has disappeared and we see a spheroidal celled carcinoma which, taken apart from its environment, might come from a breast

In some of the sections, described in detail at the end of this paper, a papillary formation can be seen to be beginning in the renal tubules at the edge of the growth (*Fig* 346) In places where the capsule is absent a gradual transition takes place between normal tubules and those commencing to proliferate The cells lining the tubes begin to get larger, and to project into the lumen, and are gradually transformed into the type of cell seen in hypernephromata When this is stated to have occurred in the case descriptions appended, it has not been done without a good deal of consideration, the difficulty of interpreting tumour formation being fully realized

The main point which this paper is written to emphasize is the occurrence of hypernephroma-like formation in conjunction with papillary adenomata and carcinomata In some cases, for example *Case* 5, a diagnosis had been made of papillary adenoma, and only further examination showed the true nature of the tumour

Histological examination also throws some light on their mode of dissemination It is well known that these growths, besides giving occasional secondary deposits in the glands, disseminate by the blood-stream, but in only one case was a mass of growth seen in the lumen of a capillary of one of the perivascular bundles They are not infrequently present in the tubules close to the growth, in the more malignant forms This may, however, be due to the fact that this is where the growth arises In *Case* 14, masses of growth are seen in a large capillary or small vein running in the false capsule Dissemination probably takes place by the invasion of one of the small veins, followed by emboli or continuous growth along their length

Secondary deposits may be single or multiple Trotter and Hymans both refer to reported cases of solitary metastases, some of which have been successfully removed Multiple metastases may occur as long as ten years after nephrectomy (Clairmont[12]) The usual interval for recurrence is from three to four years, but there are many examples scattered throughout the literature of recurrences five and six years after operation [13]

ORIGIN

To the discussion of the origin of these growths, which crops up perennially in the literature, four contributions of outstanding importance have been made In 1884 Grawitz[14][15] brought forward the hypothesis that they were due to suprarenal rests beneath the capsule of the kidney In support of this contention he produced the following evidence (1) That the growths arise beneath the renal capsule, a place where these rests are found, (2) That the cells of hypernephromata are quite unlike those found in the normal renal tubule, (3) That they are very much like the cells of the suprarenal cortex, notably in that they contain much fat, (4) That their encapsulation is very much like that of suprarenal rests accidentally found in the kidney, (5) That the disposition of the cells is much like that seen in the suprarenal cortex

The following facts militate against these contentions —

1 Although a certain number of hypernephromata do give the appearance of arising from beneath the renal capsule, *Case* 17 establishes beyond a doubt that they do not always arise in this situation Besides, the distribution of hypernephromata in the renal cortex does not correspond with that of suprarenal rests I have never read a convincing description of any suprarenal rest which was not situated beneath the capsule at the upper pole A large number of hypernephromata, on the other hand, arise in the middle or lower pole

2 The cells of hypernephromata may, in some cases, be unlike the normal renal tubules but in others, where the loops are small and rapidly growing, and only bear one layer of small cells, it is difficult to be certain that one is not looking at renal tubules and it requires reference to the surrounding structures, and a minute examination of

the stroma, to distinguish between the two sometimes very like abnormal renal tubules which are the subject of nephritis

Moreover the cells of hypernephromata are which are the subject of nephritis

3 The fact that hypernephroma cells are sometimes like those of the suprarenal cortex is not a sufficient reason for saying that they arise from suprarenal rests An abnormal cell rising from one structure may quite well simulate the normal appearance of some other structure Doubly refracting fat as seen in hypernephromata has been found by Lehlein[16] to be present in the protoplasm of renal epithelioma and carcinoma

4 I cannot deal with the question of encapsulation, as I have never seen a suprarenal rest situated in the middle of the kidney substance

5 An adequate explanation of the formation resembling the suprarenal cortex has already been given in the part of the paper dealing with the histology

There are, however, other reasons which may support the suprarenal-rest theory that have not received sufficient attention by writers on the subject

Many cases have been reported of tumours having the characteristic structure of a hypernephroma which have arisen outside the kidney, and some of the reports are very convincing Chiari[17] has recorded the case of a man, age 44, with a highly malignant tumour the size of a man's head occupying the pelvis, and reaching above to the level of the lower border of the right kidney The tumour had the structure characteristic of hypernephroma The man died of recurrence after operation and Chiari was able to demonstrate post mortem that the tumour was not secondary to a growth in the kidney, suprarenal gland or any other abdominal or pelvic organ I have not seen pictures of the sections of this growth , but simply to state that they probably were not characteristic of hypernephroma does not help one in getting at the truth, although it may assist in making out a case for some other theory Eastwood[18] has reported a case of a tumour in the uterus, the sections of which show typical transverse perivascular appearances which are quite characteristic This patient lived for some years after operation and never complained of hæmaturia It is possible that the growth which was removed at operation was secondary to a hypernephroma, but secondary deposits do not commonly occur before evidence exists of the primary growth in the kidney Another case has been reported by French[22] of a hypernephroma arising in the suprarenal body which was shown post mortem to be quite unconnected with the kidney Microphotographs of this tumour reproduced in a paper by Glynn show marked lumen formation It is hard to conceive of tumours arising from the suprarenal body forming a lumen Glynn,[23] who has examined the sections, says that it is not characteristic of hypernephromata Owing to the kindness of Dr French I have had an opportunity of examining the sections of this tumour, and, with all due respect to his very carefully considered paper, I can only agree with Professor Glynn that the tumour is not a renal hypernephroma Of course it is not inconceivable that tumours like hypernephromata, which have a papillary structure and arise from renal tubes, could also grow in other parts of the body Cases of hypernephroma have also been reported growing in the liver, a place where suprarenal rests are said to be common but in none of these cases, so far as I know, has a primary renal growth been definitely excluded A careful comparative examination of many of these extrarenal growths has recently been carried out by Professor Glynn[23] He has come to the conclusion that the majority of the pelvic growths are of luetic origin It appears from this paper that growths very similar in type to renal hypernephroma can arise in other parts of the body Research should be directed to try to discover some reason for this similarity

There are three more facts against the suprarenal-rest theory which make one hesitate before accepting it

1 It has been shown by Greer and Wells[24] that there is no adrenalin contained in hypernephromata in spite of a very careful search

2 Tumours arising in the suprarenal body as a rule produce alterations in the sex characteristics This has never been noticed in hypernephromata

3 No case of tumour in the suprarenal body has ever been proved to have a papillary structure

The first consideration does not weigh very heavily, since it does not necessarily follow that a tumour arising from any particular gland produces secretion identical with that of its parent structure   In the case of the suprarenal gland this is perhaps hardly to be expected, as a substance having the chemical properties of adrenalin would be easily altered by slight changes in its environment   However, it does help to strengthen the argument that the similarity between the two cells is one of appearance rather than of composition

The last two arguments which have just been brought forward are, however, of great importance   If tumours arising in the suprarenal body produce precocious sex characteristics, it might reasonably be expected that tumours arising in suprarenal rests would do the same   Similarly, if tumours arising in the suprarenal rests can be shown to possess an essentially papillary structure, this same appearance should be seen in those arising in the suprarenal gland   It is true beyond a doubt that practically all suprarenal tumours do not possess this important characteristic   On the whole it appears to me that the advocates of the suprarenal-rest theory have failed to prove their case

The next most important contribution to the discussion was brought forward nine years later by Sudek[25], who thought that hypernephromata arose from renal tubules and were in the nature of adenomata, and again in 1908 the whole subject was re investigated by Stoerk [26]

After bringing forward a formidable array of arguments against the theory of Grawitz, he showed that these tumours always have a papillary basis, much in the same way as has been shown in an earlier part of this paper   His description I can confirm in most respects, although the examination of these sections was not done with this end in view, in fact the bulk of the paper was written before I had read Stoerk's contribution   His contention is that Grawitzian tumours arise from regenerating renal tissue, with commencing papillary cyst formation   This, he says, is seen most commonly in chronic interstitial nephritis   A study of these sections does not always demonstrate the chronic interstitial nephritis, and I think its importance as an etiological factor has been over estimated   Chronic interstitial nephritis is such a common disease, and hypernephroma is relatively so uncommon, that if the same relationship exists between them as many pathologists think exists between chronic mastitis and breast carcinoma, these tumours should be met much more frequently   The transition which is seen between renal tubes and hypernephroma forms need not necessarily be at first in the nature of chronic interstitial nephritis   Stoerk goes so far as to say that what has been called the looped capillary type is also tubular, as well as being papillary, and that the tubules contain a secretion comparable with renal secretion, or at any rate a true secretion   What constitutes a true secretion is a matter for philosophers to determine   Certainly there often appears in the lumen of the loops a sort of colloid material which must come from the lining cells   But from the way it stains it cannot be compared with that produced by renal tubules, which does not stain at all   The true nature of this alveolar appearance has been made clear in this paper   Trotter,[27] who has published one of the best descriptions of hypernephroma that has ever been written, also remarks on the tubule formation, but he only described one case the sections of which did not demonstrate its origin

The next and last important contribution to the subject was made in 1910 by Wilson and Willis-[8] —

1   They expressed doubt as to whether suprarenal rests ever occur at all, and hazarded the opinion that the descriptions of them are often mistaken, the tissues described being really Wolffian remnants

2   They claim that hypernephromata have a predilection zone, which does not correspond to that of nephritis which is a diffuse change, also that they are seen in kidneys which show no evidence of previous inflammation

3   They state that Grawitzian tumours rarely exhibit a cell form resembling that seen in the bulk of carcinomata arising in the renal epithelium, and in their malignant form conform to the sarcoma rather than the carcinoma types

4   They have undertaken a long embryological investigation in which they show that

normally the Wolffian body intervenes between the developing kidney and the developing suprarenal, and demonstrate that from a developmental point of view rests of suprarenal tissue are most unlikely to be found in the kidney, whereas the Wolffian body, a degenerating organ close to the kidney, is therefore likely to have part of its substance included in the kidney In fact they say that kidney rests are more likely to be found in the suprarenal than vice versa May this not, perhaps, be the explanation of Dr French's case, for there was undoubtedly some developmental error present

On these grounds they proceed to construct a theory that hypernephromata arise from Wolffian rests, in spite of the fact that they have not produced a single such rest, or shown how it is possible for an amorphous mass of tissue like the Wolffian body to produce a tumour-formation essentially papillary in nature It should be noted that Wilson is not the first person to suggest that Wolffian rests may explain the occurrence of hypernephromata The idea was suggested by Kupffer in 1865 [29]

The arguments they have brought forward merit careful attention With regard to what they have said about the occurrence of suprarenal rests, they may have shown from an embryological point of view that when development takes place normally, suprarenal rests are most unlikely to occur, but they have given us no idea how often development is absolutely normal That it occasionally deviates from the average is conclusively shown by the fact that suprarenal rests do occur Targett's[30] case is a good example Professor J S Dunn,[31] among many others, has described 5 cases found in a routine examination of the kidneys in 80 post-mortems, and in his description of them he notes that they were intimately associated with the renal tubes, and were not separated from them by fibrous septa In one of his cases the capsule both of the suprarenal body and of the kidney was deficient in places Wilson and Willis have neither described nor produced a single Wolffian rest, and I cannot reconcile Professor Dunn's careful description of suprarenal rests with any existing account of Wolffian tissue

With the contention that hypernephromata have a predilection zone I cannot agree, they are found in all parts of the kidney, and *Case* 17 shows that they do not begin beneath the capsule, at any rate always That they arise in kidneys that are not the subject of a generalized nephritis is quite true, but this is no reason for stating that they do not arise from renal tubules A very great majority of them begin at a time of life when the kidney has borne the burden and heat of the day, and its tubules may reasonably be assumed to have undergone such changes as make them susceptible to the cancer stimulus

I have found that when hypernephromata begin to take on a more obviously malignant change it is first in the nature of a carcinoma Although appearances suggestive of sarcoma are seen, they can very easily be traced to the aberrant cell-formation of a carcinoma The difficulty of distinguishing a spheroidal-celled carcinoma from a round-celled sarcoma is quite well known, and as a rule the only way to do it is to trace the formation to some part of the section where its origin is made plain In none of the sections which show sarcoma forms in these series has there been any difficulty in doing this although in at least two cases, if two or three fields of the microscope only were examined the diagnosis of sarcoma would certainly have been made The conclusive proof of the carcinomatous nature of these tumours is found in the close association of hypernephroma form with papillary carcinoma and papillary adenoma The fact that Grawitzian tumours disseminate by the blood-stream is a very superficial reason for believing them to be sarcomatous in origin Any tumour of such a nature arising in a vascular gland might be expected to give secondary deposits, much in the same way as does a carcinoma of the thyroid Once the carcinomatous nature of the Grawitzian tumour is proved as has been done here, the possibility of its being a mesothelioma fades into insignificance—if one judges a mesothelioma by Adami's[32] standard

Summary —Hypernephromata are probably not mesothelial in origin, because their cell forms are similar to those arising from epithelial structures rather than from connective tissues Adami lays it down as a *sine qua non* that mesotheliomata revert to a sarcomatous structure Before we can accept a theory that hypernephromata arise from Wolffian rests the existence of such rests must be proved, instead of the mere possibility of their

occurrence raised—on rather inadequate embryological evidence   On *a priori* grounds it seems rather improbable that a tumour which has such a definite and advanced age incidence as these have should arise from a rest of any kind

The main object of all scientific research should be to describe processes rather than end-results   The necessity of putting things into a pigeon-hole and writing a label above them leads to much misconception , it is not the whole duty of a scientist merely to classify and compare, but to trace a biological process from its initiation, through its development, until it assumes a form which is familiar and has a definite label

The papillary formation, so constant in most new growths arising in the renal cortex is one of the ways in which the kidneys react to the neoplastic stimulus   Sometimes the cells on the stalk are large, granular, and vacuolated, and if the connective tissue assumes the requisite form, the tumour is called a hypernephroma   If the cells are smaller, stain more deeply, and have a regular form, and especially if they are only one layer thick, the condition is confidently diagnosed and labelled papillary adenoma   And when this pro liferation takes place obviously into the lumen of a renal tube and the cells are larger dropsical, and contain fat, we say that we are dealing with a papilliferous cyst   In some cases these forms show very rapid growth, and actively invade their surroundings , at the same time the cells get away from their stalk and congregate in masses increasing in size by active division, and a diagnosis is made of papillary or spheroidal-celled carcinoma Now it has been noticed by many writers, that in adenomata, carcinomata, and even in normal renal epithelium, fat droplets or vacuoles are present containing some substance which is doubly refracting   In hypernephromata this characteristic of the renal epi thelium is most marked, and is developed to a degree seldom seen in other growths *but it is not a characteristic essentially peculiar to these growths*

Reference to the case descriptions will show that the form of reaction of the renal tubules called hypernephroma may accompany all the others , that is to say, it has been found in sections of tumours which are mainly papillary adenomatous, or papillary carci nomatous, *even when the latter is becoming spheroidal-celled in type*   In some cases transition forms can be traced between them all   It has also been noted that the size of the cells, the amount of vacuolation, and the homogeneity of the protoplasm may vary In one case, for instance, of the looped capillary type, the cells stain as deeply as those of a papillary adenoma and are quite ungranular

Finally it has been conclusively shown that the structure of hypernephromata is essentially papillary, that is to say, that the cells grow from a fibrous tissue and capillary basement membrane   That the actual form the cells take often varies with the rate of growth and the space available   And further, that the tubular arrangement is not a true tube formation, but is accidental

Surely, no one would be bold enough to say that a papillary adenoma originates in either a suprarenal or a mesothelial rest , it can only arise in renal epithelium

Now in all carcinomata, in addition to what has been called the neoplastic stimulus, there are other factors which apparently are always present as well   They vary with the type of epithelium, but are usually irritative in nature   In squamous epithelium the common ones are heat, chronic irritation, syphilis, and mechanical trauma   Carcinoma also tends to form where the medium which bathes the cells is an acid one, particularly *in the case of columnar cells though not exclusively so, as carcinoma of the cervix is an example to the contrary*   When, in addition to the acid medium, some form of mechanical irritation is present, we have all the necessary preliminaries for the action of the neoplastic stimulus to produce its familiar reaction   Now what the preliminary irritation is in the case of the renal tubule is so far unknown but it may reasonably be expected to vary slightly with the habits of the patients and the amount of work his kidneys have to do to keep the contents of his blood normal   In the same way the type of growth will vary slightly as it does elsewhere and while in one case we get a papilliferous cyst which may progress to the usual hypernephroma form, in another there will be a papillary adenoma becoming malignant, and also producing hypernephroma-like cells as a by-product   The end-result, which is called hypernephroma, is a papillary one, and like many papillary

formations—for instance, those occurring in the bladder, renal pelvis rectum, and breast —may be for a long time completely innocent, but finally take on the characters of a carcinoma

It is not contended in this thesis that the idea of hypernephromata arising from renal tubules is a new one or that the papillary growths so frequently found have not been described by others   The explanation given of why the forms so often seen are essentially papillary I have not seen elsewhere

In view of the paper by Wilson and Willis it was quite evident that the whole subject badly needed reinvestigation   The material was examined without any desire to make a case for any current theory, but to trace some relationship between the pathological finding and the symptomatology, and to see if a study of the surgical pathology would bring forth any means of improving the operative results

I have put forward the view that the appearance usually labelled hypernephroma is a product of the malignant change of renal tubules, and forms one of the ways in which they react to a neoplastic stimulus, because it seems to me that this is a more useful conception of the disease than the one which holds it to be an isolated phenomenon arising from the capricious and somewhat belated growth of a misplaced tissue-remnant

I am indebted to the members of the staff of the Cancer Hospital for permission to report cases, and in particular to Mr R H Jocelyn Swan for much material, help and advice   To Dr Archibald Leitch, the Director of the Research Institute, I owe my thanks for a great deal of helpful criticism and assistance

DESCRIPTION OF THE CASES UPON WHICH THIS WORK IS BASED

Case 1 —A H , male, age 63   Admitted June 9, 1905

HISTORY —Five weeks ago the patient noticed that his urine was smoky and dark in the morning, although clear at night   When this had lasted a week he was unable to pass any water for some hours, but finally was relieved after passing some clots of blood the size and shape of a sixpence   Since then there has been no haematuria, but he complains of aching in the left loin, made worse by exertion   He had frequency of micturition, day six times, night once   He states that he has lost weight to the extent of one stone in the last three or four weeks

EXAMINATION — Examination of the abdomen revealed a firm rounded tumour with rather irregular margins situated in the left lumbar region   It extends from under the costal margin at the level of the ninth costal cartilage downwards as far as 2 inches below the umbilicus, and inwards to 1 inch from the middle line   It can be grasped bimanually moved as one mass and gives the sensation of being solid   It moves with respiration   A band of resonance passes transversely across it   No varicocele is present

Cystoscopy —The bladder is normal, the ureteric orifice large and patent   A small piece of pus can be seen to come from the right orifice   The mixed urine contains 1 8 per cent urea, of which 1 4 per cent comes from the right kidney

OPERATION   June 21 —The lumbar route was used   and the kidney found to be very adherent at the upper pole   A good deal of inflamed perirenal fat was removed with the kidney   The patient died from uraemia ten days after operation   At the post-mortem the vena cava and the renal vein were not found to contain any growth   and no secondary deposits were seen   The remaining kidney showed the changes characteristic of chronic interstitial nephritis

FIG 617 —*Case* 1   Section of left kidney showing large growth in the lower portion

GROSS PATHOLOGY (*Fig* 347) —The lower half of the left kidney is occupied by a large growth, the size of a grape fruit It is soft to the touch, irregular in outline, and where it distends the capsule of the kidney has formed several large bosses mainly situated along its outer convex border The capsule beneath which it lies is thickened, and has been adherent to the surrounding perirenal fat On the posterior surface is seen an irregular tear about 2 inches long and a third of an inch wide Its appearance suggests that it has been produced by pressure and distention, rather than by local invasion by the growth

The renal tissue is irregularly invaded, and there is very little attempt at encapsulation The renal pelvis is also invaded and full of growth, but the renal vein was normal

The growth is traversed in all directions by strands of fibrous tissue which have in some cases undergone hyaline degeneration There are many hæmorrhagic areas, most of which lie adjacent to the connective tissue strands The tumour substance is cystic and necrotic, but in the masses of the growth are some yellow areas of fatty degeneration

HISTOLOGY —The four sections which have been cut from various portions of this growth confirm the impression formed from a study of its microscopic appearance All the usual forms assumed by hypernephromata are present, the predominating feature which is common to all sections is that the cells grow in much larger masses than usual, in parts they have altogether lost their relationship to the capillaries and grow in clumps large enough to fill up a whole field of the microscope In many of these clumps the cell protoplasm stains very well, and there is a marked absence of the usual granular and vacuolated appearance In other parts the cells contain some highly refracting material, and conform to the hypernephroma type The appearance of the section adjacent to the renal tubules would puzzle any expert to decide whether he is dealing with a transition between renal tubules and hypernephroma formation, or whether the cell masses above described are invading tubules which are the subject of nephritis

In chronic interstitial nephritis from which this patient suffers, the nuclei of the cells usually keep fairly constant in form, and the first change in the malignant degeneration which will be described in other sections seems to be that the nuclei become larger and irregular in form This cannot be seen here although there are typical hypernephroma cell masses which appear to be growing from the wall of the tube One feels after considering the surrounding tissue full of cell masses, that the true explanation is that these masses are invading the tubules Two other points of interest are seen , (1) The stroma from which the cells arise can be seen in one section to be quite clearly continuous with that forming the false capsule of the tumour, and in this section the growth conforms to the looped capillary type , (2) The presence of a fairly large vein being invaded by a mass of growth thus showing the mode of dissemination

FIG 348 —Kidney in Case 2

Case 2 —Male, age 43 Admitted Oct 17, 1906

HISTORY —Five years ago the patient had an attack of hæmaturia lasting two or three days Previous to this there had been no pain or inconvenience Four years ago he had an attack of painless hæmaturia which was followed every two or three months by other attacks lasting two or three days During one attack he had clot retention During the last nine months he had one bout of pain radiating to the groin and for the last three months there has been a consistent aching in the right loin

EXAMINATION —A small hard tumour is palpable in the right kidney region There is also dullness of the right base

OPERATION Oct 30 —Usual lumbar incision The liver was found to be pushed downwards and to the left The tumour was delivered in spite of some difficulty caused by adhesions to the diaphragm No reply has been received to inquiries made regarding this patient

GROSS PATHOLOGY (*Fig* 348) —In this specimen the only piece of kidney tissue recognizable is a small portion of the lower pole The kidney pelvis is unrecognizable as such, and the ureter distended with growth, runs downwards from the upper and inner aspect of the tumour The high position of the ureter suggests that the growth originally arose from the lower or middle portion of the cortex The renal vein, also full of growth, can be seen on the interior aspect, running inwards across the greatly thickened and distended pelvis The fibrous capsule of the kidney has been extensively invaded at its upper pole, so much so that it is practically non existent

Looking at the cut surface of the growth, one sees that above it is solid and finely lobulated, and has the appearance of a piece of pancreas Below this it shows rounded areas of cystic degeneration each separated from the other by fibrous strands These cysts contain blood clot in various stages of organization and at their edges one can see a thin layer of shreddy necrotic growth

HISTOLOGY —In all four sections taken from various parts of the tumour the transverse perivascular arrangement predominated, in fact it is here seen in its typical form In the centre of the system is a capillary which is surrounded by a variable amount of connective tissue Sometimes there appears to be none at all, and one is tempted to say that the cells arise from the capillary endothelium, on the other hand, the connective tissue might be quite thick, and arranged in fine strands around the vessel Usually one can clearly distinguish then endothelial lining from the surrounding connective issue upon which the hypernephroma cells grow The first layer of cells is small and cuboidal, as they approach the periphery they become larger, rather club shaped, until in many cases the outermost cells become masses of protoplasm which stain well and are multinucleated Another section shows well defined papillary formation, and adjoining it many renal tubules from which the growth may arise, they are unfortunately too closely packed for any definite conclusions to be reached on this point

In still a third section, the well ordered form has disappeared, and the appearance is that of a spheroidal celled carcinoma made up of large vacuolated cells, which are continuous with those growing from the outer layers of a perivascular system In another place the section might almost be taken for a round-celled sarcoma growing in a richly fibrous stroma

Case 3 —Female, age 58 Admitted Jan, 1909

HISTORY —Nine months ago the patient fell out of a dog-cart, fractured her right wrist, and bruised her back A month later she had an attack of hæmaturia at first the urine was deeply blood stained and the same evening she passed clots The hæmaturia rapidly cleared up and was unaccompanied by pain Seven months ago, that is to say a month after the first, she had another short attack of slight hæmaturia Five months ago there began acute pain in the right loin, followed by hæmaturia and the passage of long rounded clots This attack lasted three days and entirely subsided Three months ago she had another attack of right-sided lumbar pain bad enough to cause vomiting, but this time there was no hæmaturia Two months ago there was a slight attack of hæmaturia, and again another recently, accompanied by typical renal colic, the urine then contained rounded clots like her little finger These attacks were always brought on by jolting or train journeys For the last two months the patient has had a constant aching in her right side She has had no frequency of micturition, but thinks she has lost weight Three days ago her doctor found the right kidney to be low, enlarged, and very tender A swelling can be seen by the patient

EXAMINATION —The patient is a fairly stout woman who has lost weight The right kidney is easily palpable, it is rounded, firm, tender, and movable It feels elastic Pressure brings on the same pain she has recently had The urine is smoky, acid, and has a specific gravity of 1017 Albumin and blood are present Between the attacks of hæmaturia no albumin was found

Cystoscopy —A twelve ounce distention was obtained The bladder was normal, and so were both ureteric orifices Good clear effluxes were seen, but they were rather infrequent although contractions of the ureter were frequent on the right side On the left side the effluxes were good and frequent

OPERATION Jan 24 —The usual lumbar incision was employed The perirenal fat and fascia were thick and adherent Nearly five years after, in Sept, 1913, the patient died from cerebral embolism There was no clinical evidence of any secondary growth

GROSS PATHOLOGY (Fig 349) —Occupying the upper of the middle two fourths of this kidney is a growth shaped rather like a figure eight It is placed obliquely, and slopes upwards and outwards The inner loop is the size of a shilling, and invades the kidney pelvis The outer loop projects from the convex border beneath the capsule which is tightly stretched over it It is about the size of half a crown The photograph (Fig 350) shows that the growth considerably distorts the pelvis as well as invades it The external aspect of the tumour has a bossed appearance, and in one spot the capsule is invaded The pelvis and all calices are full of growth and blood clot but the renal vein is uninvaded The growth in section is solid and white and has a lobulated glandular appearance owing to numerous fibrous trabeculæ which it contains There is a hæmorrhage into the substance the size of a cherry Between the growth and the kidney is a continuous false capsule of condensed renal tissue

FIG 349—Case 3 Showing shape of the growth, distortion of the pelvis and blood clot and growth blocking the ureter

HISTOLOGY —Various sections of this growth give a picture of the greatest interest (1) There is in one section a large area of renal tubules showing a transition between normal tubes and others close beside them having their cells larger elsewhere, and containing bigger nuclei Close beside them there is a rather dilated tubule containing a mass of hypernephroma cells apparently

arising from the tubules   There is nothing in this section to suggest that the tube has been
invaded by growth, in fact the invasion of kidney tubules by hypernephromata of typical form
is not commonly seen   The tubes may be compressed or obliterated, but are seldom invaded
(2) One of the slides shows typical examples of the looped capillary and papilliferous form in
addition to these renal tubules   The cells are large, vacuolated, and in every way conclusively
hypernephromatous   This is of great interest, because in sections of growth which take the

Fig. 350 — *Case 3*   Illustrating the outer appearance of the kidney in *Fig* 349

papilliferous carcinoma formation   the co-existing hypernephroma cells, although typical, are
usually small, and conform to the malignant type rather than the adenomatous   (3) In other
sections the bulk of the tumour is entirely papillary, the cells of which it is composed very much
resemble those of the renal tubules in their staining reaction and general appearance, and all
gradations are present between these and the large club-shaped vacuolated hypernephroma cells

Case 4 —M A C , female, age 5 ,   Admitted Sept 14, 1909
HISTORY —This patient has never had hematuria, but she complains of a tumour in the left
loin which had been present for thirteen years   Recently it has been increasing in size   The
only pain she has had is an occasional backache, and there has been no frequency of micturition
EXAMINATION —A large freely movable tumour the size of a foetal head can be felt in the
left loin   It extends from below the left costal margin to an inch below the interior spine, and
reaches a point one inch to the right of the umbilicus laterally   In consistence, the tumour is
firm and inelastic   It can be pushed up from the pelvis but is partially fixed in the left flank
OPERATION   Sept 24 —A left rectus incision was employed   After dividing the peritoneum,
the kidney was delivered with difficulty, as it was adherent behind   A mass of glands was seen
in front of the vertebral column on the left side   They were not removed   Patient died with
pneumonia a few days afterwards
GROSS PATHOLOGY (*Fig* 351) —In this large specimen there are only two portions of kidney
tissue recognizable   These are the inner parts of the upper and inner end of the kidney   They
are placed opposite each other on the mesial aspect of a huge tumour the size of a foetal head   It
is round and smooth in outline and covered by a very thick but remarkably non-adherent capsule
With the exception of the lower calyx, the whole pelvis is unrecognizable, as it is completely
obliterated by growth   The vessels in the pedicle cannot be seen in the half of the tumour which
remains for examination, but the clinical notes do not state that the vein was involved   On
section the whole of the centre of the tumour is occupied by a mass of organized and laminated
blood clot the size of an orange   This clot is surrounded by a thick, nearly continuous band
of fibrous tissue which has undergone hyaline degeneration   The rest of the growth is disposed
round the periphery of this haemorrhage in the form of rounded solid masses, whose cut surfaces
have a lobulated appearance   There is very little degeneration of any kind
HISTOLOGY —This section is very interesting, as it illustrates the change from the more simple
adenomatous type of growth to the malignant   In one section there is seen mainly the looped

capillary formation The loops are small, there is lumen formation in only a few places, but where seen it is quite definite The cells are tightly packed together their protoplasm stains well and is very granular Vacuolation and fatty degeneration are not so marked as in many specimens Giant cell formation is present The nuclei show active mitosis There are many small strands of fibrous tissue to be seen bearing the capillaries In one part of the section the longitudinal formation is present, and the appearance of the cortex of the suprarenal is simulated In another section the general appearance, though similar to the first shows that the cells are not so tightly packed and a reticulated appearance is produced, and into the reticula the cells can be seen to proliferate In still a third section close to the capsule the appearances are of great interest There are tubules some nearly obliterated by pressure, others ovoid, and again still others have more nearly preserved their original shape Many of these have a double layer and are nearly filled with cells, and from some of them a bud of cells, large, granular, and vacuolated in appearance, is seen to arise from the side wall

It is easy to say that these tumours are merely a slightly abnormal variety of the looped capillary or reticular formations so commonly seen and one has tried to convince oneself that this is so But the close association of this early formation of the type of cell so characteristic of these tumours with the normal renal tubule, and the gradual transformation of the one into the other usually beginning by a papilliferous proliferation, makes it hard to resist

Fig 331 —Illustrating the structure of the tumour in Case 1

the conclusion that this is the way in which the tumours arise The next slide taken from another part of the tumour shows the end result of the process whose beginning has just been described Here the cells are actively invading the renal tissue In parts the section looks like a large round celled sarcoma in a richly fibrous stroma, in other parts it resembles a spheroidal celled carcinoma, and elsewhere traces of the original papillary structure are easily distinguished The cells are large, rapidly growing, and spheroidal in shape The nuclei are big, and actively dividing

Fig — Illustrating the values in Case

Case 5 —P, female, age 59 Admitted January, 1911

HISTORY —Two and a half years ago the patient had an attack of hæmaturia which was quite painless No clots were passed The bleeding continued on and off for six months, each attack lasting two to three days Six months later a more severe attack occurred and the patient stayed in bed three weeks, when a diagnosis of papilloma of the bladder was made This painless bleeding continued again for six months, at the end of which there was another bad attack Ten days ago the kidney was seen to be enlarged on the right side Throughout the case there was no frequency pain, or difficulty of micturition

EXAMINATION —Patient is a thin woman, and does not look her age The right kidney can easily be palpated It moves with respiration and can be grasped above, the outline of its lower border is lobular No blood or pus was present in the urine, but there was slight albumin

Cystoscopy —Bladder normal The right orifice was situated on a papilla There was no surrounding congestion and a faint dribble of clear urine was seen to come from the orifice

OPERATION Jan 9 —Usual lumbar approach The upper pole of the kidney was adherent, and as far as possible was removed with its surrounding fat Patient died on July 6, six months later, with recurrence in the abdomen and lungs

GROSS PATHOLOGY —This growth (*Fig* 352) occupies the whole of the upper two thirds of a slightly large kidney   The capsule is not invaded, but is thickened, and shows a slightly bossed outline   There is no evidence of the usual encapsulation, and the normal outline of the organ is not greatly distorted   The renal cortex, the pelvis, and the renal vein, are extensively invaded   The cut surface shows the usual lobulated appearance in a well marked form, the lobules being smaller and the tissue between them finer and more abundant than one sees in most cases   Close to the more obvious trabeculæ are two small areas of hæmorrhage

HISTOLOGY —Two sections have been cut from different parts of the growth   One of them is of special interest, for it shows on the same slide hypernephroma and papillary carcinoma   The latter for the most part is typical, but in some places, particularly close to the vascular stalks, the cells are larger, vacuolated, and contain highly refracting material   Their nuclei are large, and in some cases contain mitotic figures   These nuclei show a marked contrast to the smaller, better stained and more homogeneous nuclei seen in other parts of the section   Close to the mixed formation that has just been described is a large area showing the usual hypernephroma forms, which have undergone much degeneration

Case 6 —A F , male, age 50   Admitted April, 1911

HISTORY —Seven months ago the patient s urine was blood stained   The bleeding was fairly profuse at first, and later only slight   A month ago renal aching began and has since been constant   It is made worse by exertion   The hæmaturia varies in amount but is never entirely absent   Clots and mild colic have also been noticed   There has been no loss of weight and no frequency of micturition

EXAMINATION —Patient is a stout, well nourished man   On palpation there is tenderness in the left iliac fossa and loin   Specific gravity of the urine 1020   Albumin and blood present

Cystoscopy —Bladder normal   Blood was seen coming from the left ureter and clear urine from the right   The x rays show a faint, ill defined shadow at the lower pole of the left kidney

OPERATION, March 1 —Lumbar incision   The kidney was found to be adherent above, and the growth was in the lower pole   No sign of any recurrence three years later, in July, 1914

GROSS PATHOLOGY —In the lower pole of this kidney is a mass about the size and shape of a billiard ball   Separating it from the renal tissue above is a broad band of condensed kidney substance, in some places an eighth of an inch thick   It is not continuous all round the tumour

The lower portion of the capsule is distended, and so tightly stretched that the hæmorrhage can be seen through it although it is not actually invaded   The perinephric fat is slightly adherent   The whole of the renal pelvis, which is bifid, is full of growth and blood clot, the veins are not invaded   The cut surface of the tumour shows very little trabeculation, and is not lobulated in appearance   It is necrotic in the centre, and its lower portion has been destroyed by a fairly recent hæmorrhage   These features are well shown in the photograph (*Fig* 353)

HISTOLOGY —The kidney substance included in the section shows chronic interstitial nephritis   The growth is a papillary carcinoma   In one part of the section the mosaic appearance characteristic of hypernephroma can be seen, the cells are vacuolated and contain a fatty material

FIG 353 —Illustrating the tumour in Case 6

Case 7 — C J male, age 57   Admitted March, 1911

HISTORY —Three months ago the patient passed blood stained urine which contained some clots   The attack lasted three or four days and brought with it no pain or discomfort   Granular and hyaline casts were present in the urine   Since then there have been three less severe attacks, the latest only lasting a few hours and giving no pain   During the intervals the urine is clear   These attacks seem to follow exertion   During the last two months he has lost a stone in weight

EXAMINATION —X rays show no definite enlargement and no calculi   No physical signs are found in the abdomen

Cystoscopy —Bladder normal   There was slight enlargement of the left lobe of the prostate   The right ureteric orifice was normal and gave a clear good efflux   The left orifice was larger, and the effluxes were frequent and forcible   After cystoscopy the patient had another attack associated with pain in the left loin and the passage of clots

OPERATION March 8 —Usual lumbar incision   There seemed to be some infiltration of the perinephritic fat   Patient perfectly well nine years later

GROSS PATHOLOGY (*Fig* 354) —The tumour is situated at the upper of the middle two-fourths of the left kidney The kidney itself is small and contracted and shows the appearances typical of chronic interstitial nephritis The growth is spheroidal in shape and has a diameter of about two inches Two thirds of its circumference project from the kidney and distend the fibrous capsule, which is thickened over the growth The remaining third traverses the renal cortex, almost touching the upper calices In outline it is smooth and rounded It appears to be definitely surrounded by a continuous capsule of condensed kidney substance No growth can be seen in the pelvis, ureter or renal vein, and externally the capsule of the kidney is not involved by the tumour It is not possible, without destroying the specimen, to see whether any of the calices are slightly involved, but some breach of continuity of the pelvic epithelium may perhaps be deduced from the patient's last attack of hematuria

The cut surface of the growth shows a mass of connective tissue about the size of a split pea placed towards the centre From this, well marked strands radiate to the periphery, and give lateral branches throughout the tumour substance The growth itself is very necrotic, and much of it is destroyed by recent hemorrhage, but where it is solid and organized it presents a distinctly lobulated appearance

HISTOLOGY —In the sections of this tumour the looped capillary type is well seen There is marked lumen formation, into the centre of which papillary ingrowth frequently takes place Here and there the lumen appears to contain some kind of colloid material In another place the capillaries are cut longitudinally and there is so little fibrous tissue around them that a perithelioma is simulated The blood spaces are wide and the whole section loosely arranged

FIG 354 —Section of kidney showing the tumour in *Case* 7

FIG —From a Photograph of specimen in *Case* 8

Patient died of pneumonia seven years afterwards
GROSS PATHOLOGY —A photograph of this specimen is shown in *Fig* 355 The growth

Case 8 —H A L , male, age 72 Admitted Aug 3, 1911

HISTORY —Two months ago the patient's urine was brown , there was then neither frequency nor pain Three weeks later he had an attack of severe pain in the left loin lasting one to two hours, after which his hematuria was much increased It was unaccompanied by sickness or colic and no clots were passed Since then he has had no pain at all, but has been troubled with hematuria varying in quantity, which has been increased by exertion Lately there has been some frequency of micturition and the patient has had to get up once every night

EXAMINATION —The patient is a stout man whose left kidney is just palpable on deep inspiration

Cystoscopy —Bladder normal Prostate was slightly enlarged The right ureteric orifice was small, the left slightly larger As no efflux was visible, a catheter was put in the right ureter and the urine which drained along it contained 1 5 per cent of urea Under the anaesthetic the left kidney was felt to be definitely enlarged

OPERATION —The usual lumbar incision was employed, and the tumour the size of an orange, was seen projecting from the anterior surface of the kidney The perirenal fat was adherent to the tumour, and as much as possible of it was removed There was no sign of any recurrence

projects from the anterior surface of a rather large kidney about midway between the upper and lower poles   Its size is about that of a grape fruit, its outline is smooth where it is covered by thickened capsule, but shaggy and irregular over its most anterior part where it is adherent to, and actively invading, the perirenal fat which has been removed with it   The renal pelvis and ureter are full of growth and recent blood clot   A section made through the growth into the pelvis reveals practically no encapsulation   Most of the tumour substance is destroyed by a large hæmorrhage which is beginning to be organized into the laminated appearance usually presented by old clot   In the middle of this hæmorrhage are four solid areas of whitish lobulated growth, granular in appearance and necrotic in the centre

HISTOLOGY —Four sections have been cut of this growth   In three of them the most prominent characteristic is that of a capillary carcinoma arising from the renal tubules   The stroma is fairly abundant and in places quite thick and cellular   From its sides grow several layers of cells which in many cases bear a marked resemblance to those lining normal renal tubules   In other parts of the section the fibrous tissue is arranged in quite definite loops, and lumen formation containing papillary ingrowths is clearly seen   Another section shows, in addition to the formation above described, the ordinary appearances of a hypernephroma   The cells are large and vacuolated, and can be seen to grow from the outer wall of a large capillary   Looped forms are easily distinguished, and here and there a longitudinal perivascular system is seen   Where the growth begins to take a papillary form, an interesting transition can be observed from the large granular and vacuolated cell to the smaller highly staining cell in the papillary part of the growth

Case 9 —E V , male, age 50   Admitted Oct , 1912
HISTORY —Twenty years ago the patient had an attack of pain in the left side, which was accompanied by hæmaturia   For the last two years he had been losing weight   One year ago the patient's urine was for two days tinged with blood   and two days later still he had aching in the left loin   Since then he has had four similar attacks of less severity   and three months ago his left kidney was found to be enlarged   His hæmaturia was not accompanied by colic or frequency of micturition
EXAMINATION —Left kidney is enlarged and nodular, and the lower pole reaches the iliac crest   His doctor says it has increased in size during the last four days   The urine contained a trace of albumin   X rays show an enlarged left kidney
Cystoscopy —Normal bladder   On the right side the renal function was normal
OPERATION, Oct 19, 1912 —The kidney, which was removed together with the perirenal fat, was densely adherent at the upper pole   Three months afterwards the patient noticed a hard fixed lump at the lower end of the scar   This was explored but not completely removed   The pathologist reports it to be in actively growing hypernephroma   The patient died of recurrence in the left iliac fossa, liver, and lungs, four months after operation, in Feb , 1913
GROSS PATHOLOGY —This large growth arose in the upper and outer aspect of the kidney The upper and inner part of the kidney is very compressed, and surrounds the inner margin of the growth   The outline is rounded and smooth where it distends the renal capsule, the capsule itself being very thick and adherent to the perirenal fat, and in one place invaded   The renal vein is not invaded, but the upper calyx contains growth   There is a well marked, thick, continuous line of false encapsulation all round the tumour   Inspection of the cut surface of the growth shows that it has undergone fatty degeneration to a considerable degree, which is most marked above   Several subcapsular hæmorrhages are present   Among the columns of lobulated growth are four little cysts, each about the size of a small shot
HISTOLOGY —Three pieces have been taken from this tumour for microscopic examination , one of them is much too degenerated for accurate diagnosis , the second presents an appearance similar to that of the cortex of the suprarenal body   the third is taken through the growth where it joins the kidney tissue, and shows typical renal tubules and marked fibrous tissue increase, thus accounting for the albuminuria   When one looks at that part of the slide closely adjacent to the growth, one sees a state of things which illustrates the mode of formation of these tumours The lumen of the tubes begins to get larger, the cells lining them bigger, and their protoplasm more granular   Close to these tubes one sees that the cells are reduplicated instead of being one layer thick, the outer layer being more globular in form   In other tubes one can clearly see small papillary ingrowths   The cells are large cuboidal in form, and have large irregular nuclei   A little further away still are ovoid spaces full of large vacuolated cells arranged in layers on their lining walls
There are some difficulties in drawing conclusions from these sections because, although transition forms are clearly present and certainly arise from renal tubes, the typical hypernephroma forms are rather a long way from them

Case 10 — A W , male, age 23   Admitted Feb 7, 1913
HISTORY —Two months ago patient complained of difficulty of micturition, which was relieved by passing a clot   Hæmaturia continued for five weeks, but has been absent for the last three weeks   There has been no renal aching or colic
EXAMINATION — A large solid tumour which filled up the left loin could be felt bimanually It moved with respiration, and the upper pole of the kidney could be felt above it   The colon could be percussed as a resonant band in front of the tumour

Operation Feb 10 —An incision six inches long was made through the left rectus The kidney, together with the perirenal fat, was delivered with much difficulty After the pedicle was divided and doubly ligated, the renal vein was seen to be full of growth, and several lumps—which were probably glands—were seen at the junction of the renal vein with the vena cava A hernia developed in the scar after operation In making the incision it was noticed that the rectus was very thin and friable, and a vessel was nearly torn across in clamping No reply was given to inquiries as to the result of operation

Gross Pathology —The whole of the upper three fourths of the specimen is composed of a large mass of growth, whitish in colour, smooth in outline, and roughly pyriform in shape From the bottom of this, a small piece of apparently normal kidney about the size of a half crown projects downwards

The growth is about three inches long by two and a half wide Its consistence is much more solid than most of these tumours, and it shows no evidence of degenerative cyst-formation

The renal pelvis and vein are invaded by growth The fibrous capsule covering the upper part of the kidney is thickened, and adherent to the perinephric fat, but there is no definite evidence of actual invasion In section, from a macroscopic point of view, this tumour is interesting in that the usual degenerative changes are absent The appearance of the surface resembles that of a rather fibrous cut veal The fibrous tissue runs in roughly parallel columns from above downwards The strands are thin, they communicate with each other by transverse branches, and in their interstices is the solid tumour substance There is only one area of haemorrhage, about the size of a small shot The edge of the tumour which comes in contact with the renal tissue shows very little evidence of capsule formation

Histology —Unfortunately it is impossible to obtain more than one section of the growth The appearance it presents is of the large loop type The connective tissue is much thicker than usual and contains many thin walled capillaries It runs throughout the section in large loops and forms a basement membrane for the cells, which proliferate into its centre The first cell layers are regular and columnar In the succeeding layers the cells rapidly become larger and more irregular, till in the centre are the common cell masses so often seen The cells are of the usual vacuolated variety, and contain much highly refracting material Their nuclei are irregular in form and show very obvious mitotic figures

Case 11 —J H T, male, age 59 Admitted April, 1918

History —Two months ago patient complained of constipation, which was relieved by aperients One month ago he felt ill and was losing weight His temperature rose to 102° in the evening Two weeks ago he had a slight attack of haematuria lasting one day He had frequency of micturition day 5 times, night 3 times Five days ago the urine was claret coloured and contained a few clots During his illness he has had attacks of pain in the left groin not associated with haematuria This was fairly severe, and accompanied by nausea

Examination —The patient looks ill, his tongue is red and dry, his pulse tension low The left kidney is distinctly large and palpable It is slightly tender, and appears to have round bosses projecting from it No other physical signs X rays show a large opaque area in the left kidney region On one examination his urine showed a fair amount of pus, no organisms, and no tubercle bacilli were found It was sterile on culture Later there was only a trace of albumin and no pus He passed 60 ounces in twenty four hours

Cystoscopy — Nothing abnormal seen

Operation — Usual lumbar exposure The perirenal fat was very adherent at the lower pole Many vessels running in the fatty capsule were clamped There was a recurrence in the scar two weeks later and the patient died April 1919

Gross Pathology —The growth is situated in the upper pole of the kidney, which it entirely replaces It is about the size of a large orange, but very irregular in outline It forms several large bosses in the upper and lateral aspect of the kidney some of which have invaded the capsule The lower and inner part of the organ appears as a thin semilunar strip placed on the growth like a cap and it only communicates with the rest of the organ by a thin strand of renal tissue and the upper calyx The false capsule is thin and discontinuous and in its intervals the growth invades the renal tubules The pelvis is invaded from a branch in its epithelium in one of the lower calices On section the tumour shows no sign of false encapsulation, but strands of fibrous tissue give it a lobulated appearance Haemorrhage has taken place in the more actively growing areas but this is not extensive and is close to the fibrous strands In other places the growth is necrotic

Histology This section is an interesting example of the looped-capillary type The loops are large and sometimes fill a whole field of the microscope The vessels running round them are clearly to be distinguished

The cells arising from the interior of the loops are of a low columnar form, as they get nearer to the interior they increase in size In very many cases the whole centre of the loop is occupied by a colloid looking substance which stains with Van Gieson Examination with a high power gives the impression that it is the product of the breakdown of the larger hypernephroma cells Faint outlines of some of the cell walls can be seen, these are deficient in parts of their outline and the protoplasm of the cell mingles with the colloid matter without Further away still its staining reactions are lost and it is a mere amorphous mass The undegenerative cells

are markedly vacuolated   They are large and stain well, even with a low power, well marked nuclei can be seen

In places where the loops are quite small the common alveolar appearance is presented   In the centre of the section is a large mass of connective tissue   It contains thin-walled capillaries of all sizes, and running from the capsule of the tumour it spreads out in all directions, giving lateral branches to the surrounding tissue

Case 12 —S   male, age 55   Admitted Oct   1919
History —Five weeks ago, while on a walking tour, the patient passed bright red blood stained urine   The attack lasted three days, was not associated with pain or discomfort, and gradually cleared up   Towards the end of another attack a few days later, there was severe pain in the left loin accompanied by nausea and sweating   The pain lasted eight hours and then ceased   Soon after this a worm-like clot was passed   Since then there has been no symptom whatsoever but renal aching
Examination —The left kidney can just be palpated on deep inspiration   Urine clear, acid specific gravity 1010   No albumin
Cystoscopy —Nothing abnormal found   The efflux from the left ureteric orifice was less frequent than from the right   *X* ray showed normal renal shadow   Since cystoscopy he has had another attack of hæmaturia and has passed a worm-like clot
Operation —Usual lumbar incision   The perirenal fat was very abundant and adherent at the upper pole   As far as possible it was removed with the kidney   Patient is at present alive and well
Gross Pathology —The growth in this case is about the size and shape of a tangerine orange   It is situated at the upper pole of a rather large kidney   The fibrous capsule is slightly distended by the growth and adherent to the perirenal fat, which is not actually invaded   Where the tumour comes into relation with the kidney substance there is a thin line of compressed tissue   The upper calyx of the pelvis has been involved and is full of recent blood-clot   The renal vein is not involved   The cut surface of the tumour shows a thick connective tissue framework surrounding many small and broken up lobules of growth   Many of these are destroyed by hæmorrhage, and others show areas of fatty degeneration
Histology —Sections show the typical appearances of the looped capillary type   The cells grow into the centre of the loop, which in some places contains hæmorrhage   It is quite plain that the loops are formed by capillaries   for here and there the loops are not continuous, and a papillary arrangement results   The cells are very vacuolated , the nuclei fairly regular and granular   The formation is very constant, and there are no aberrant cells and hardly any papillary formation

Case 13 —E   B , female, age 52   Admitted Feb , 1921
History —Nine months ago patient complained of a sharp pain in her upper abdomen, which was more marked in the left hypochondrium   It was accompanied, but not relieved, by vomiting   At the same time the urine contained a large amount of blood and a few clots   The attack lasted one day and passed away   The urinary tract was then x rayed and no abnormality seen   Six months ago she had a similar attack which lasted three days   Since then she has had constant renal aching   She stated that she had been losing weight for the last year
Examination —On palpation of the abdomen slight tenderness was elicited around the umbilicus   The right kidney was palpable but not enlarged and the left kidney was not felt   Urine, specific gravity 1012   no albumin, pus or blood present , no tubercle bacilli were found , urea concentration test showed in the second hour that the urine contained 3 9 per cent urea   The blood urea was 0 07 per cent   X ray report   The left kidney region shows an increased mottled density, extending outwards beyond the renal area
Cystoscopy —Bladder normal   Indigo carmine test showed that although the colour appeared in the urine secreted by the right kidney twelve minutes after injection, no colour came from the left ureter until twenty minutes had elapsed, and it was then noticed that the concentration of the urea was distinctly weaker than on the right side   On account of this diminution of function it was decided to explore the kidney
Operation —Usual lumbar incision   The kidney was removed with its perirenal fat and no glands were seen or palpated   The normal relationships of the structures in the renal pedicle were disturbed, and great care was necessary in isolating them   Patient left the hospital alive and well, Feb , 1921
Gross Pathology —The left kidney shows a spheroidal swelling about the size of a tangerine orange growing from the vicinity of the pelvis   The ureter passes across its posterior surface   Dissection shows it to be uninvaded   A section cut right across the kidney reveals an apparently encapsuled tumour varying in consistence and colour and for the most part necrotic   In one spot the tumour is invading the calices
Histology —The predominating appearance in these sections is of the looped capillary type   All the other typical forms are also present   Giant-cell formation is fairly frequent, and in some places they are obviously coming from the edges of the cells opposite their capillary origin   Mitosis is obviously taking place and fatty degeneration is very widely spread   The surrounding cortex shows some interesting changes   In places the tubes come right up to the tumour tissue

Here and there, some distance from this border a solitary tube is seen cut off from its neighbours The capillary stroma of the cortex can be seen to be continuous with that of the tumour In between the tubes one can see the beginnings of chronic interstitial nephritis Pressure has blocked the veins and left the arteries unchanged consequently there is some round-celled infiltration, and hæmorrhage into the lumina of the tubes has taken place Hence the hæmaturia

In the following five cases the clinical notes relating to the kidney tumour are unavailable, in three of them the tumour was found accidentally post mortem

Case 14 —

GROSS PATHOLOGY —The kidney, removed at operation six months before the patient died, shows there is a large growth the size of a grape fruit, growing from the inner aspect of the upper pole It projects from the capsule, which has a smooth round outline The perirenal fat is extensively adherent to the tumour, and the section shows that it had been invaded in two or three small scattered areas, each about the size of a small shot The renal vein and pelvis are full of white soft growth On section it is seen that the lower two-thirds of the tumour has a thin capsule, but the fact that the upper calyx is extensively involved shows this encapsulation to be entirely spurious In consistence the growth is soft, and section shows that there is much necrosis and hæmorrhage so that the usual lobulated appearance is lost

The patient died about six months after leaving the hospital, and secondary deposits were found post mortem in the lungs, liver, brain and vertebræ

HISTOLOGY —The examination of sections cut from various parts of the growth throws much light on the probable origin of these tumours In two of these sections are seen the typical appearances usually associated with hypernephroma The transverse perivascular type is the least frequent of them all Typical giant cells are also present A study of the few perivascular formations that exist shows clearly how what has been termed the looped capillary type comes into being Several of the larger capillaries can be seen to give a branch which runs in a circular direction, nearly returning to its parent vessel From the walls of these branches come the usual cells filling up the space they enclose In some cases there is only one layer of cells and consequent lumen formation The longitudinal formation can also be seen, and with it the formation resembling the cortex of the suprarenal body

The interest of this specimen is not by any means exhausted towards the edge of the growth another block was cut and it showed a few apparently normal renal tubes, and next to them others with their lining cells bigger and more granular Side-by-side with them one sees these cells beginning to proliferate into the lumen of the tubules, and half a field of the microscope away typical papillary formation can be easily seen A little further away still is the ordinary looped capillary arrangement Another point of interest to be seen is that masses of hypernephroma cells are inside the lumen of a rather wide capillary Similar masses are also in the vessels running in the false capsule which surrounds the tumour

The fate of these little cell masses can be studied in another section taken from a secondary deposit in the brain Here only a suggestion of the original arrangement can be made out The appearance of the cells is much more ragged, their outline amorphous, and in many cases they are more multinucleated masses lined close to a capillary wall The protoplasm stains much more evenly and there is much less vacuolation than in the parent growth One would have doubts as to the origin of this deposit if the transverse perivascular arrangement was not seen in one part Similar appearances are met with in the sections taken from secondary deposits elsewhere

Case 15 —

GROSS PATHOLOGY —In this specimen the growth has arisen from the upper and inner extremity of the left kidney In shape it is pyriform the apex being separated from the upper calices only by the usual false capsule which surrounds the growth and which is deficient at the extreme inner edge only The renal capsule is greatly distended, and on the anterior surface is invaded by four large bosses of growth The pelvis in the half of the specimen available for examination is intact and so are the renal vessels

With the exception of a mass of white lobulated growth, contiguous to the renal pelvis, and a thin line a quarter of an inch wide surrounding the periphery, the whole growth is converted into a large cyst the size of a tangerine orange Its walls are shaggy and necrotic, and in places old blood clot is adherent to them

HISTOLOGY — The interest of the sections centres in the fact that one of them has the appearance of a papillary carcinoma while in the other it is obvious the tumour is a hypernephroma A section taken from a secondary deposit in the lung gives the appearance of a carcinoma with a trace of papillary formation The cells stain well show remarkably little vacuolation, and have small round nuclei The transverse perivascular and longitudinal perivascular systems are clearly seen but the tissue between them is tightly packed, and every now and then large multinucleated masses which stain much more deeply than the surrounding cells, can be seen The main mass of cells comprising the growth are vacuolated, though small and conform to the hypernephroma type The tumour formation cannot be traced with any degree of certainty to renal tubules In another section the appearance presented is that of an encephaloid carcinoma,

and might well come from a breast, since the only difference that can be observed is that many of the cells have distinct thin walls and their protoplasm is vacuolated In other parts there are cell masses in which the cell outlines have entirely disappeared

A further examination of a secondary deposit in the lung shows it the edge of the growth in obvious transverse perivascular arrangement

Case 16 —

GROSS PATHOLOGY —This tumour has destroyed all but a small piece of the lower pole of the kidney It is about the size and shape of a huge William pear the lower thin apex of which would correspond to the part of the tumour which occupies the space between the renal pelvis and the capsule It is surrounded by a very thick, fairly continuous layer of stretched renal tissue, except where it is in contact with the unaltered kidney, which it actively invades The capsule of the tumour is so thick that one suspects it is composed of more than mere compressed kidney tissue, and that the tumour arose somewhere in the middle of the renal cortex The growth has destroyed all the remains of the outline of the pelvis, which is obliterated by a solid mass of growth The kidney capsule and the renal vein are intact

The cut surface of the tumour shows solid columns of growth which have a serpiginous outline Along the edges of these columns is seen a faint red line of hæmorrhage presumably coming from vessels in the stroma In the region of the pelvis is one large recent hæmorrhage, which extends upwards for about an inch into the tumour tissue Areas of fatty degeneration are also seen

HISTOLOGY —The sections from this growth show far too much degeneration to allow of any valid deductions being made One can only say that it is a hypernephroma from the appearance of the few cells that are left They are large, vacuolated, and generally surrounded by a mass of amorphous material A careful survey of the fibrous stroma that remains, and in the meshes of which the cell outlines can be seen confirms the view put forward of the papillary structure of these tumours Here and there it forms complete loops with a large lumen, and in many cases a stalk denuded of its cells projects into the centre In parts of the section the fibrous tissue has undergone hyaline degeneration

Case 17 —(Fig 356)

GROSS PATHOLOGY —This specimen is of great interest in that it was discovered accidentally post mortem in a man who had died from epithelioma of the tongue It is the earliest case on record of a hypernephroma It is a small localized growth situated in the renal cortex, at about the junction of the upper and middle thirds It is separated from the capsule by a band of normal kidney tubule half an inch in width, and thus could not possibly have arisen from a subcapsular suprarenal rest It is a round growth about the size of a marble, thinly but definitely encapsuled In cross section it has all the typical characteristics of a hypernephroma It is lobulated in appearance, there is a tiny spot of necrosis in the centre, and one or two small foci of fatty degeneration can be made out It does not invade the pelvis of the kidney, nor does it touch the capsule posteriorly, and the vessels are normal

HISTOLOGY —The examination of the section is disappointing It shows the ordinary looped capillary type, and in some places a mosaic appearance is produced by the fact that the cells are closely packed together This packing of the cells makes it impossible to get any indication as to their origin It is completely surrounded by a thin layer of compressed renal tubule

FIG 356 —Photograph of specimen from Case 17

Case 18 — A G, female age 65

EXTRACT FROM POST MORTEM NOTES —This patient had a large, septic, fungating growth in the breast It was a typical scirrhous carcinoma on section, and appeared to have no connection with the renal tumour which was accidentally discovered

GROSS PATHOLOGY —This small growth is situated at the lower pole of the left kidney , it is about the size of a hen s egg, and projects downwards beneath the capsule The pelvis, the renal vein, and the perirenal fat are quite uninvaded The substance of the growth is almost entirely destroyed by hæmorrhage, both recent and old It appears to be separated from the kidney by a thin but definite band of compressed renal tissue

HISTOLOGY —This tumour is far too degenerated to draw any accurate deduction from One small area surrounded by much necrotic material shows a papillary adenoma of the type so often seen beneath the capsule of normal kidneys Here it apparently arises from adjacent renal tubules Close by cells lining the fibrous tissue stalks seem to be undergoing a gradual transition from the small cell usual in papillary adenoma to the large one characteristic of hypernephroma In another section, cut by chance through undegenerated tissue, the appearances are almost entirely those of a papillary adenoma

Case 19 — A C male, age 62   This patient died in the hospital of carcinoma of the rectum before any operation could be performed   He had had no symptoms of any renal disorder

POST MORTEM NOTES — The growth in the rectum was, both from a macroscopic and microscopic point of view, an undoubted columnar carcinoma   Growing from the lower pole of the left kidney is a mass about the size of a small peach, which projects from the organ and distorts its normal outline   It is more prominent behind than in front, where it has a bilobed appearance   The capsule over it is greatly thickened, and on its anterior aspect the perirenal fat has been invaded by growth over one small area   Separating the upper portion of the growth from the kidney substance is the usual false capsule   On section the growth is very hæmorrhagic and necrotic   The renal pelvis and vein are quite intact   in its upper part is a mass of fibrous tissue the size of a threepenny piece, from which run trabeculæ throughout the kidney substance

HISTOLOGY — The section is very much broken up by hæmorrhage   The transverse, longitudinal, and looped capillary systems can be seen   the giant cell formation is frequent   in one place only there is a commencing reticular arrangement

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PSEUDO-COXALGIA

(*Osteochondritis Deformans Juvenilis Coxæ   Quiet Hip Disease*)

A CLINICAL AND RADIOGRAPHIC STUDY

By HARRY PLATT, MANCHESTER

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TREATMENT

HISTORICAL INTRODUCTION

IT has long been taught that in the common hip joint affection of childhood—tuberculous arthritis—rapid spontaneous healing may occur, with the production of a joint which shows little or no ultimate interference with its function   Thus Brodie,[1] writing in 1834 on scrofulous disease of joints, states   " If the joint receive very early attention, the function of the joint may be wholly unimpaired " Hugh Owen Thomas,[2] from his vast clinical experience of hip disease, wrote in 1875   " Many cases have a strong tendency to recover   These are the cases that sometimes recover spontaneously (an extremely rare occurrence), and may recover but with defect, never reaching the destructive stage though neglected '   In more recent times we find Rollier,[3] of Leysin, well known as an advocate of heliotherapy in the treatment of bone and joint tuberculosis, in presenting an analysis of cases of tuberculous arthritis of the hip-joint treated between the years 1903 and 1913, stating that, out of the total number cured, 73 per cent showed restoration of joint function   Rollier affirmed at this date that articular function was almost always preserved in the patients who were treated by his methods under the exceptional climatic conditions

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of the Swiss mountain slopes. He was insistent on the certainty of obtaining a *restitutio ad integrum* in the majority of cases of hip disease, and he claimed that such patients in city hospitals were able to attain cure only through the intervention of ankylosis. From his radiographic studies of the hip-joint during the process of natural healing, he enunciated the principle that only one-third, or at the most one-half, of the head of the femur was ever destroyed by the active disease.

But since 1903 the German school of surgeons, led particularly by Hoffa,[3] had described cases of hip joint disease of a non-tuberculous nature, occurring in young adults, adolescents, and occasionally in children, and comparable with the arthritis deformans (hypertrophic or osteoarthritis) of later life. Then, again, the elucidation of the pathogenesis of the various types of coxa vara emphasized still further the existence of certain mild or inconspicuous disabilities of the hip-joint, which in the past had sometimes been included on clinical grounds in the category of true hip disease. But allowing for the general recognition of such definitely non-tuberculous affections as these, the opinion embodied in the conclusions of Rollier, quoted above, might be said to be current surgical teaching until the beginning of the last decade.

In 1909 Legg[5] of Boston, in a communication before the American Orthopædic Association, described a small group of cases, 5 in number, in which were exhibited the symptoms of a mild hip disease with distinctive radiographic appearances—viz., flattening of the upper epiphysis of the femur and a broadening of the femoral neck. Legg pointed out that cases of this type had formerly been regarded as examples of benign tuberculous arthritis, but he considered that he was now dealing with a definite entity, a hip-joint affection of a non-tuberculous type. He suggested, as an explanation of the pathogenesis of the condition, that a previous trauma had produced an alteration in the vascular supply of the upper end of the femur, and that the characteristic bony changes were the direct result of this disturbance. In the same year, Waldenstroem,[6] of Stockholm, had described a series of hip joint cases showing radiographic changes similar to those seen in Legg's patients, but he considered that these were examples of primary tuberculous osteomyelitis of the upper part of the neck of the femur, the joint cavity itself remaining unaffected. Sourdat[7] of Paris in a study of 250 radiograms of supposed tuberculous arthritis of the hip joint, published in 1909, had already distinguished in 9 plates certain well-defined changes which in a later scrutiny proved to be identical with those described by Legg and Waldenstroem. It appears that Calvé, of Berck, was responsible for directing the attention of Sourdat to this small series of distinctive radiograms which represented a special form of hip disease, soon after to be designated by the former author as *pseudo coxalgie*. In 1910[8] Calvé's paper appeared containing a detailed consideration of 10 cases which had come under his notice in a series of 500 patients suffering from presumed tuberculous coxitis. These cases differed from ordinary hip-joint tuberculosis, one of the chief features being, as in Legg's cases, a peculiar radiographic change. Calvé regarded this as an atypical manifestation of rickets, the usual stigmata of which were present in all his patients. Independently, in the same year, Perthes,[9] of Tubingen, published a careful account of the clinical and radiographic signs of one type of arthritis deformans juvenilis which proved to be identical with the condition described by Legg and Calvé. In a further communication in 1913, based on an observation of 21 cases, Perthes[10] reiterated the now well recognized symptomatology and radiographic signs, and withdrawing his original designation of arthritis deformans, submitted the term osteochondritis deformans, as in his view there was an entire absence of true arthritic changes. A year later, from the Tubingen clinic, Schwartz[11] presented an elaborate study of what was now beginning to be recognized as a definite entity, and in reporting 22 cases, laid special stress on 10 which had been followed over periods of from two to fifteen years.

This condition from now onwards appeared in the German literature under the title of Perthes' disease. It is interesting to note that prior to 1914 Legg's original and subsequent contributions had been overlooked or ignored in the various German monographs on the subject. Although, as recently pointed out by Sundt,[12] epitomes of Legg's first paper appeared in three Teutonic periodicals in 1910. Pseudo-coxalgia, or osteo-

chondritis deformans juvenilis, had now become almost universally recognized by surgeons who had special opportunities of dealing with a large number of hip joint affections From a number of clinics a retrospective analysis of a large series of cases, formerly considered and treated as tuberculous disease of the hip joint, demonstrated the fact that many radiograms showed the appearances characteristic of this condition

Since 1915 there has been a steady addition to the literature on this subject from various countries, viz , America, France, Scandinavia, Great Britain Germany, and Italy, and more than 300 cases have been reported up to date   The names of Legg, Calve, and Perthes must remain conspicuously associated with the original recognition of this disease, and Legg s study of 55 cases, published in 1916,[13] remains one of the most authoritative expositions on the subject   Perthes, since his original contribution, has published two additional notes ,[14] but the largest series of cases observed in one clinic is that of Sundt[15] (75 in number), published in 1921

Some of the more recent literature has shown a polemical flavour (Perthes, Sundt[15], Waldenstroem[16], and Frangenheim[17]), as the question about the priority for the original discovery has been raised   Thus Frangenheim now claims to have described the condition himself in 1909, and further states that the first recognition of the disease dates back to 1898   and is to be attributed to Maydl   In this connection it is to be remembered that, to day, a retrospective analysis of any series of hip joint affections in children, or of a large number of hip joint radiograms, will always bring to light examples of pseudo coxalgia

THE CLINICAL PICTURE OF PSEUDO COXALGIA

It will be convenient at this juncture to establish on the sure foundation of unanimity the broad clinical picture which is characteristic of the affection under consideration, and which stands out in the now somewhat voluminous literature   The various minutiæ of the symptomatology will then be approached and discussed as they are seen to be illustrated in a clinical study of the writer s personal material   From this we may proceed to a consideration of the nature of the radiographic changes and to a critical review of the theories of the pathogenesis of pseudo-coxalgia   The question of terminology arises at the outset , the affection has been endowed with several titles, some of which are quoted above   It is proposed in this paper to use, purely as a matter of convenience, the short and non committal designation pseudo coxalgia

The disease is met with in children in the first decade of life the majority of cases being seen between the ages of 5 and 9   It is admittedly more common in boys, and its inception is often associated in the minds of the parents with some recent injury in the region of the hip   Usually the earliest sign is a limp, insidious in its development, often intermittent, and accompanied by little or no discomfort   In some cases the onset is more acute, and the presence of pain in the hip and knee may be sufficiently marked to merit attention   The actual physical signs at any time are often few, and are characteristically at variance with the classical signs of tuberculous arthritis of the hip joint   Thus, there is little or no atrophy of the thigh and buttock and there is a complete absence of localized thickening or swelling of the soft tissues overlying the joint The mobility of the hip varies according to the particular stage at which the examination is conducted   It is by no means unusual to find the joint fixed completely by muscular spasm, and yet at the same time absolutely painless   Such complete spasm is, however, transient, and very soon the joint shows the more typical slight restriction of mobility affecting exclusively the movements of abduction and internal rotation   After a variable period of active signs and symptoms, there is seen a steady progress towards the complete subsidence of any subjective phenomena   The recovery at first sight appears to be of the nature of a return to normal, but careful examination will usually show that there is a slight residual limitation of mobility in the affected joint

The whole clinical picture is thus that of a mild hip-joint synovitis, fleeting in character   At any time during the phase of active symptoms, or after the complete disappearance of these, the hip joint shows a cycle of osseous changes demonstrable in

radiograms These changes are sufficiently distinctive in type to have been regarded as pathognomonic, and upon their recognition depends not only the certain diagnosis of pseudo coxalgia but its relegation as an entity to a special niche amongst the varied morbid affections of the hip joint

ANALYSIS OF THE WRITER S PERSONAL MATERIAL

During the past five years clinical and radiographic observations have been accumulated on the cases of pseudo coxalgia which have made their appearance from time to time under my care In an attempt to investigate the complete clinical life-history and cycle of bony changes occurring in this lesion with a view to the elucidation of its pathogenesis it has been necessary to make a wide comparative survey of the large amount of hip-joint material which has gravitated towards my surgical services This has involved a study of about 300 hip-joint conditions and a critical scrutiny of over a thousand radiograms

For the special purposes of this paper a series of 35 cases has been selected, divided into four distinct groups —

Group 1 —Pseudo coxalgia in childhood—18 cases
Group 2 —Pseudo coxalgia   the end result in adult life—5 cases
Group 3 —Arthritis deformans juvenilis of the hip-joint—5 cases
Group 4 —Miscellaneous hip joint affections in which flattening of the head of the femur is seen   coxa plana—7 cases

Group I —PSEUDO COXALGIA IN CHILDREN

Number of cases 18 (20 hip joints) Unilateral, 16   bilateral, 2   Males 9   females, 9 Right hip 12   left hip 8

Case 1 H B   Right hip   Period   year since onset of symptoms   Femoral head shows early flattening with almost uniform calcification   femoral neck shows broadening and a rounding off of its epiphyseal shows the internal trabeculae of the neck   shows irregularity of no particular type

Case 1 H B male age 10 Right hip
History and Mode of Onset —Pain in the right hip following a fall, said to have had a definite night cries Diagnosis of early tuberculous arthritis made, admitted to a tuberculosis sanatorium where he remained for six months traction being applied to the hip Under this treatment pain and local tenderness quickly subsided
Condition on first Examination April 24, 1920 —Admitted to country hospital one year after the onset of symptoms
No pain or tenderness slight generalized under development of the right lower limb, no

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localized muscle atrophy Hip showed limitation of the range of abduction and internal rotation only, thickening of the trochanter palpable, shortening nil

Rickets No signs of old rickets
X ray appearances See *Fig* 357
Tuberculin test (von Pirquet) Doubtful
Wassermann test Not carried out
SUBSEQUENT COURSE —Immobilization of the hip joint (abduction frame for three months) short plaster spica and weight bearing Irregular pyrexia noted

Aug 27 1921 —Attending ordinary school, leading a normal life No symptoms, no visible limp Hip is adducted, but there is not complete muscular spasm Considerable limitation of abduction and internal rotation, especially the former Trochanteric thickening is marked, no shortening
X ray See *Fig* 358
Comments —Duration of observations one year and seven months Osseous changes is demonstrated by radiograms slight after one year Subsequent further flattening of the head with irregular fragmentation Continued existence of adduction contracture

FIG 358 —*Case* 1 11 months later The head shows increased flattening with fragmentation of the bony nucleus and expansion with nods The change is progressive

Rickets Slight residual signs
X ray Head of femur shows slight flattening with early fragmentation, broadening of the neck with spongy texture in subepiphyseal region
Tuberculin and Wassermann tests Both negative
DIAGNOSIS —Typical pseudo coxalgia

Case 2 —O B, male, age 8 Right hip
HISTORY AND MODE OF ONSET —Limp and pain referred to the knee and hip, no history of trauma, duration of symptoms two months
CONDITION ON FIRST EXAMINATION, June 6, 1921 —Right hip shows limitation of abduction and internal rotation, trochanteric thickening is evident No pain or local tenderness no atrophy or shortening Limp just perceptible

FIG 359 —*Case* 1 1
Left hip Period 1 year and 10 months since onset of symptoms Femoral head shows advanced changes flattening to the stage of a thin crescent with active fragmentation and enlargement outwards to well outside the margin of the acetabulum Femoral neck shows well advanced broadening and rounding off with irregular texture in the subepiphyseal region

SUBSEQUENT COURSE —Treatment by immobilization in double plaster spica, no weight bearing

Nov 7 1921 —Still immobilized
X ray Shows fragmentation of the head progressed still further neck changes more prominent

Comments —Pseudo coxalgia in the active phase osseous changes progressing during immobilization and protection of the hip from weight bearing

Case 3 —L B male, age 7   Left hip

HISTORY AND MODE OF ONSET —Limp and pain in the hip, symptoms intermittent , no history of trauma , duration one year

CONDITION ON FIRST EXAMINATION, June 14, 1920 —Barely perceptible limp   Left hip fixed in slight flexion and negative abduction by muscular spasm , all movements are lost   No pain or local tenderness , trochanter shows thickening   no muscular atrophy

Rickets   No stigmata are present

X ray   Changes typical of pseudo coxalgia far advanced   Head shows marked flattening with fragmentation and hypercalcification   Neck shows widening and spongy texture

Tuberculin and Wassermann tests   Both negative

SUBSEQUENT COURSE —No local treatment irregular attendance of the child for observation

Feb 28, 1921 —Spasm of the hip completely disappeared   Considerable restriction of abduction and internal rotation present   trochanteric thickening well marked   No limp or pain

Nov 5 —Symptomless   Physical signs as before , still under observation

X ray   See *Figs* 359, 360

Comments —Duration of observation seventeen months   Illustrates the stage of complete spasm with spontaneous disappearance

Case 4 —I B , female, age 7½   Left hip

HISTORY AND MODE OF ONSET —Limp   no trauma   Diagnosis of tuberculous arthritis made, and prompt immobilization treatment instituted in hospital in the south of England   After six months' recumbency with traction, a long plaster spica was applied with the hip in abduction
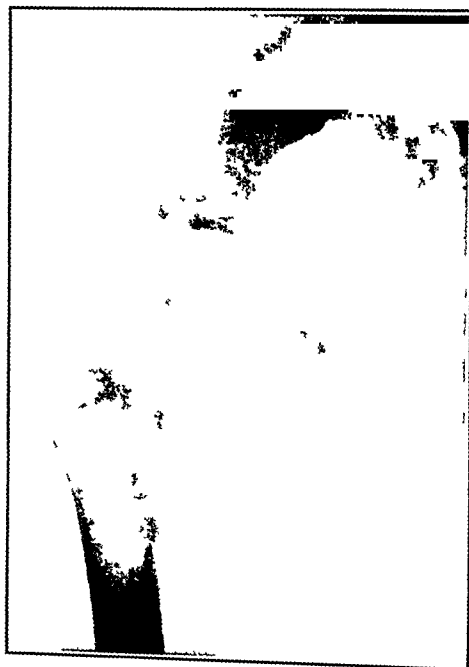
FIG 60 —*Case* 3 6 months later   Reconstruction changes in the head   this is creeping still further towards the trochanter but its internal structure is becoming more uniform
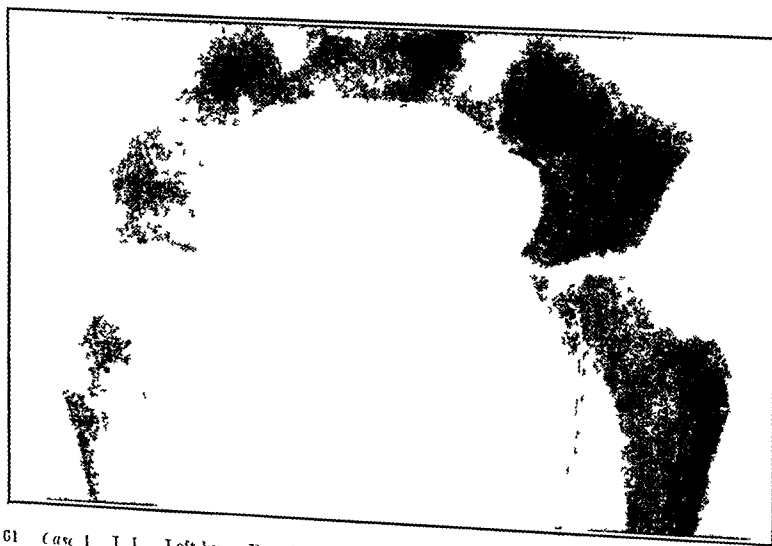
FIG 61 *Case* 4 I I   Left hip   Period since onset of symptoms 1 year   Head shows well marked flattening and outward expansion   the bony texture suggests the reconstruction phase   The radiogram was taken at the end of one year's immobilization (six months in plaster of I m)   The absence of generalized bone atrophy in the femur and pelvis is striking

CONDITION ON FIRST EXAMINATION, Oct 24, 1921 —One year after the onset of symptoms she reported at the hospital wearing a long plaster spica which had recently cracked   On removal of this the hip was found to be fixed in slight abduction, but free movements could be obtained after gentle manipulation, except in the direction of abduction and

internal rotation   There was a striking absence of muscular atrophy, and no evidence of local tenderness   Trochanteric thickening prominent, no shortening   Child began to walk without any discomfort immediately after removal of the plaster

X ray   See *Fig* 361

Tuberculin and Wassermann tests   Both negative

Comments —Typical pseudo coxalgia with moderate flattening of the head of the femur, which is in the reconstruction phase

Case 5 —M H, female, age 6   Right hip
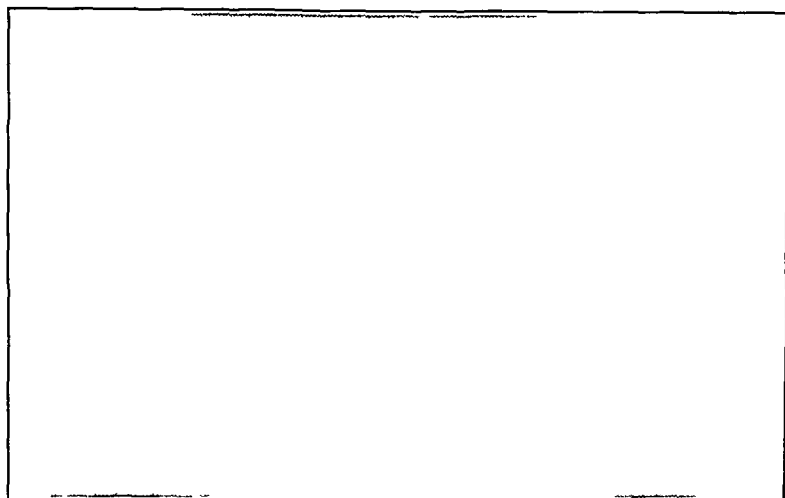
FIG 362 —*Case 5*   M H   Right hip   Period since onset of symptoms   1 year and 3 month   Hip shows moderate flattening   lateral expansion is well marked   bony texture is irregular   Neck show   widening and rounding off
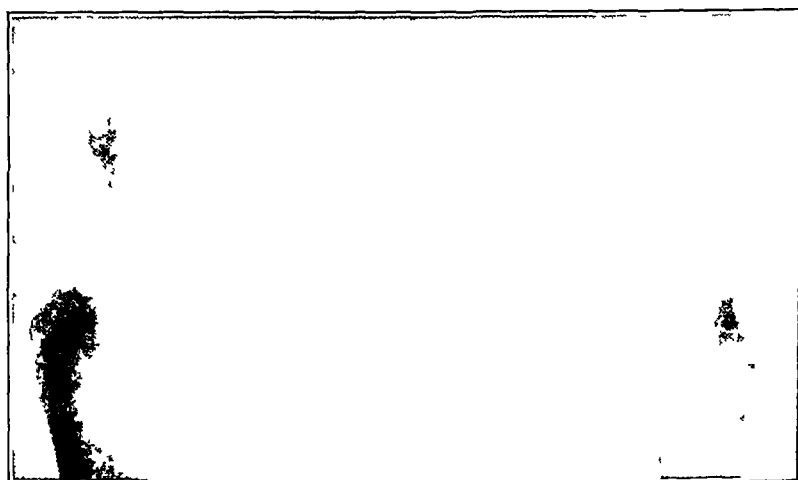
FIG 363 —*Case 5*   3 years and 2 months later   Head shows extreme deformation   crescentic flattening with enlargement to far out side the acetabular margin   calcification is uniform   Neck is short   widened and rounded off   The acetabular contour is altered in conformity with the changes in the head

HISTORY AND MODE OF ONSET —Early symptoms   pain in knee and hip   Diagnosis of tuberculous arthritis made, and immediate fixation adopted, wore single Thomas hip splint for one year   No history of previous trauma

CONDITION ON FIRST EXAMINATION, April 20, 1918 —No symptoms   Right hip shows moderate degree of limitation of abduction and internal rotation, trochanteric thickening is evident   No obvious muscular atrophy, no shortening

Rickets   No signs

Tuberculin and Wassermann tests   Both negative

X ray   See *Fig 362*

SUBSEQUENT COURSE —No recurrence of symptoms during ensuing three and a half years Child has been examined regularly, and repeated radiograms have been taken

Comments —Duration of observations three years and four months   Persistence of troch interic thickening and limitation of abduction (slight)   Radiographic evidences of reconstruction of head of femur leaving a permanent deformation, viz , enlargement and flattening (see *Fig 363*)

Case 6 —H H mile, age 6   Right hip

HISTORY AND MODE OF ONSET —Pain in the right hip and limp, one months duration, no history of trauma

CONDITION ON FIRST EXAMINATION, April 11, 1921 —Slight limp, no pain or local tenderness Right hip shows limitation of abduction and internal rotation   Trochanteric thickening is evident

X ray   See *Fig 364*

Tuberculin and Wassermann tests   Both negative

Rickets   Faint residual signs

SUBSEQUENT COURSE — Immobilization in double plaster spica, six months

Oct 11, 1921 —Removal of plaster   Child began to walk immediately without discomfort Physical signs as before

X ray   Apparently little change from the appearances of seven months before, fragmentation slightly less

Comments —Duration of observations seven months   Early flattening of femoral head, which has not advanced to the stage of fragmentation

Case 7 —T H , male, age 9   Bilateral pseudo coxalgia

HISTORY AND MODE OF ONSET —Limp and pain in the right hip , history of preceding injury

DIAGNOSIS —Tuberculous arthritis , hip immobilized and protected from weight bearing for two years

CONDITION ON FIRST EXAMINATION, Dec 3, 1917 —Seen after the recent discarding of the hip splint , no symptoms, slightly waddling gait

Right Hip —Well marked limitation of the range of abduction , no atrophy or shortening , troch inter showed no difference when compared with the opposite side   *Left Hip* —Examined at the same time , showed a surprising limitation of movements in all directions, especially affecting the range of abduction, which was less than on the right side   The left hip was painless and no symptoms had ever been referred to it

X ray   Right hip—moderate flattening of the femoral head, as seen in *Fig 365*   Left hip— head of the femur is flattened to an advanced degree, bony nucleus is fragmented, and neck presents broadening

Tuberculin and Wassermann tests   Both negative

Rickets   Slight residual signs

SUBSEQUENT COURSE —No return of symptoms at any time

March 10, 1918 —Cystic swelling developed in the left popliteal space   This was dissected out and at operation proved to be an enlarged semimembranosus bursa   Under anesthesia it was noted that the right hip was freely mobile in all directions, but the limitation of abduction of the left hip was still present

Feb 24, 1919 —Still no symptoms   Right hip shows slight limitation of abduction of the prominent, the left more than the right   to a greater degree   Both trochanters are unusually

Sept 1, 1921 —Physical signs is before

Comments —Duration of observations four years   Bilateral pseudo coxalgia, symptoms involving one hip only, for which treatment appropriate to tuberculous arthritis was adopted   At the end of two years the symptomless hip which had borne weight during this period showed more advanced radiographic appearances and a greater degree of restriction of mobility   Both joints show a reconstruction of the femoral heads with progressive deformation, more advanced on the left side   (See *Figs 365* and *366*)
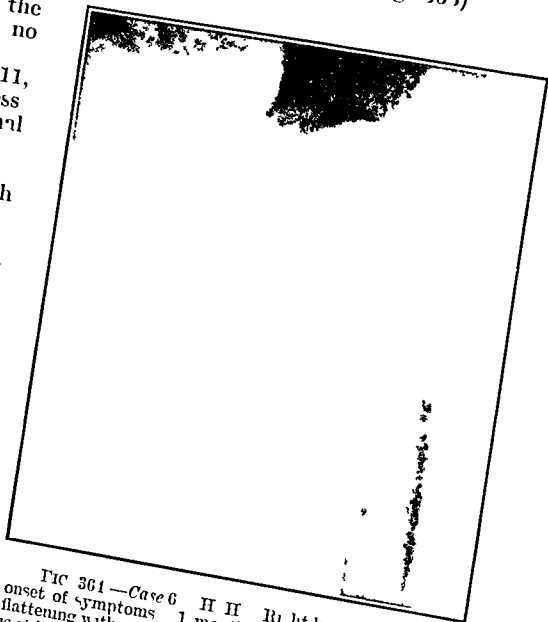
FIG 361 —*Case 6   H H   Right hip   Period since onset of symptoms   1 month   Head shows moderate flattening with early dissolution of the bony nucleus   it is still within the limits of the acetabular cavity   Neck shows rounding off, broadening, with rarefaction in the subepiphyseal region*

Case 8 —J K H , male, age 9   Left hip

HISTORY AND MODE OF ONSET —Pain in the hip, and referred to the knee   intermittent limp
History of a blow over the trochanter, duration one year   No treatment during this period

FIG 26)—Case 7   J H   Bilateral pseudo-coxalgia   Period since onset of symptoms   2 years
Right Hip —Head shows flattening of the cap type with expansion to just outside the acetabular line   bony
texture shows uniform calcification   Neck shows a little broadening and rounding off
Left Hip —Head shows a more advanced phase, crescentic flattening with marked expansion   Neck is short
wide, and rounded off
This picture shows the phase of complete reconstruction of the femoral head with the persistence of advanced
deformation

FIG 27G—Case 7   2 years later
Right Hip —Has arrived at the stage shown by the left hip in the previous figure   The femoral head is still more
crescentic and has grown out of the acetabulum
Left Hip —Shows little alteration and evidently demonstrates what is practically the final stage

CONDITION ON FIRST EXAMINATION, June 1, 1920 —Admitted to country hospital on account
of increasing pain and limp   Hip slightly painful and fixed in flexion by spasm, all movements
lost   No real local tenderness or swelling of the soft parts   Slight under development of the
buttock and thigh noticeable on inspection   By gentle manipulation a little true mobility
could be obtained in the hip, but the range of flexion, abduction, and internal rotation was
diminished to a striking degree

X-ray   See Fig 367
Tuberculin test   Negative
Wassermann test   Not carried out
Rickets   No signs

SUBSEQUENT COURSE —Hip abducted under anesthesia and long plaster spica applied

limitation of abduction and internal rotation was noted to be present even when complete relaxation was obtained

September, 1921 —Still immobilized Duration of observations fourteen months Hip shows limitation of mobility in all directions due to spasm

X-ray   Reformation of the femoral head is taking place, acetabulum is correspondingly less irregular than before

Comments — Advanced subchondral destruction' of the femoral head, with well marked acetabular changes Persistence of muscular spasm over a prolonged period

Case 9 —G L, female, age 12 Right hip
HISTORY AND MODE OF ONSET —Limp, insidious and intermittent, Vague history of trauma

FIG 367 —Case 8 J K H Left hip Period since onset of symptoms Seven Head show advanced fragmentation and the whole contour is irregular Neck shows broadening and rounding off with pumice like internal structure The acetabular roof shows parallel change exceedingly well developed Note —In this case muscular spasm has persisted over an unusually prolonged period

CONDITION ON FIRST EXAMINATION, March 11, 1918 —Complains of aching pain in right hip after walking, duration one year Right hip shows moderate reduction in the range of abduction and internal rotation, trochanteric thickening Rickets Stunted girl, marked signs of old rickets

X-ray   Femoral head shows crescentic flattening with hyperclarification and fragmentation, head does not extend beyond the acetabular margin, neck short and broad

Tuberculin and Wassermann tests Both negative

SUBSEQUENT COURSE —Examined occasionally during ensuing twelve months, after which patient lost sight of No change in physical signs Radiograms unsatisfactory

Comments — Pseudo coxalgia in a markedly rachitic child

Case 10 —W M male age 7 Left hip
HISTORY AND MODE OF ONSET —Slight pain in the knee, two months duration No trauma

CONDITION ON FIRST EXAMINATION, March 21, 1921 —Left hip joint fixed by spasm painless, trochanter thickened and prominent No atrophy local tenderness or swelling of the soft parts

X-ray   See Fig 368
Tuberculin and Wassermann tests Both negative
Rickets No definite signs

FIG 368 Case 10 W M Left hip Period since onset of symptom - month Head shows moderate flattening with early fragmentation and slight extension Neck how broadening and rounding off

SUBSEQUENT COURSE —Treatment by immobilization in plaster spica under anesthesia, with hip abducted

Aug 10 —X-ray   See *Fig* 369

Nov 7 —Still immobilized   X-ray appearances at this date shown in *Fig* 370

Comments —Duration of observations eight months   Radiographic changes well advanced with short duration of symptoms , increased fragmentation of the femoral head followed by commencing reconstruction during immobilization
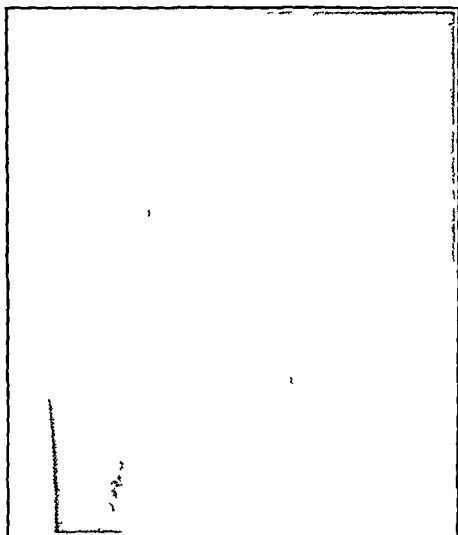
FIG 369 —*Case* 10 9 months later   Hip has been immobilized without weight bearing   shows further fragmentation of the head
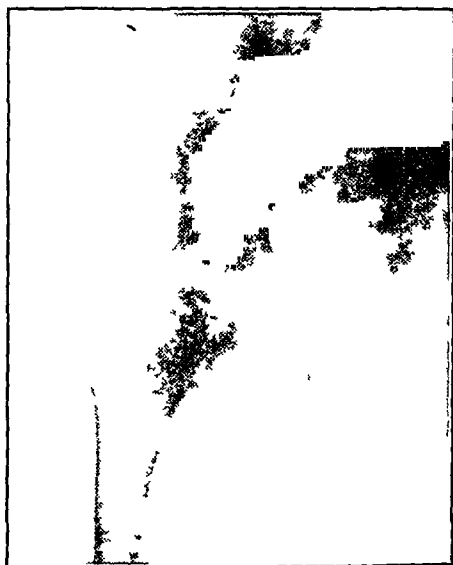
FIG 370 —*Case* 10 3 months later than in *Fig* 369   Head shows signs of restoration of contour with commencing fusion of the fragmented areas
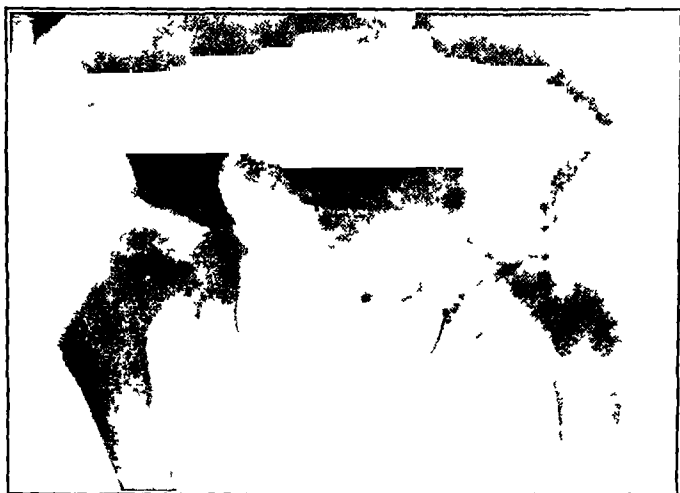
FIG 371 —*Case* 12   L M   Bilateral pseudo coxalgia   Period since onset of symptoms   4 months
C Light Hip —Head shows extreme flattening and is reduced to an attenuated strip   hypercalcification but no actual fragmentation   Neck shows broadening and rounding off with spongy internal texture
Left Hip —Head shows fragmentation   dissolution of the inner half of the bony nucleus   Neck is shortened but shows no other striking feature   The acetabular roof presents a curious crenated appearance

Case 11 —S M , female, age 6   Right hip

HISTORY AND MODE OF ONSET —Early symptoms unknown   Treated during two years as tuberculosis of the hip - joint by immobilization and protection from weight bearing   Complete disappearance of symptoms and signs of any disability

CONDITION ON FIRST EXAMINATION, March 3, 1919 — Referred for examination from Special Day School for Crippled Children

No trace of limp , hip shows slight diminution in range of abduction only   Trochanter appreciably broadened in antero posterior diameter

X-ray   Femoral head shows slight flattening with 'cap'-like formation   Neck is shortened but is very little broadened   The head has expanded slightly to just outside the acetabular line

Tuberculin and Wassermann tests   Both negative

Rickets   No signs

Physical signs unchanged

SUBSEQUENT COURSE —Continues to remain without symptoms   Radiographic signs stationary

Comments —Period of observations two years   Spontaneous restoration of the head of the femur to almost normal , illustrating a mild type of pseudo coxalgia

Case 12.—L M , female, age 6   Bilateral pseudo-coxalgia

History and Mode of Onset.—Stiffness of *right* hip , no symptoms referable to the left hip
Duration four months , no trauma

Condition on First Examination, June 4, 1917.—*Right Hip*.—Fixed by muscle spasm
Trochanter prominent and thickened , head of the femur is unduly prominent in Scarpa's
triangle and feels enlarged

Left Hip.—Free mobility in all
directions

X-ray   See *Fig* 371

Tuberculin and Wasser-
mann tests   Both negative

Rickets   Slight signs

Subsequent Course.—
Child lost sight of for nearly a
year, since then has been under
regular observation   No active
treatment has been carried out

July 15, 1918.—Symptom-
less   No limp   *Right hip* shows
limited abduction and internal
rotation, with trochanteric
thickening   *Left hip* shows
absolutely no recognizable ab-
normality

June, 1920.—Physical signs
unchanged

X-ray   See *Fig* 372

Aug 9, 1921.—No change
in signs

X-ray   See *Fig* 373

Comments.—Period of ob-
servations four years and five
months   *Right hip* shows a con-
siderable deformation of the

FIG 372.—Case 12, 3 years later
Right Hip.—Head shows advanced flattening with marked expansion
irregular calcification   Neck is squat and broad
Left Hip.—Head is reconstructed and shows a very slight alteration from
the normal contour or size   Irregular calcification is present

femoral head   *Left hip* shows a restoration practically to normal after early fragmentation signs
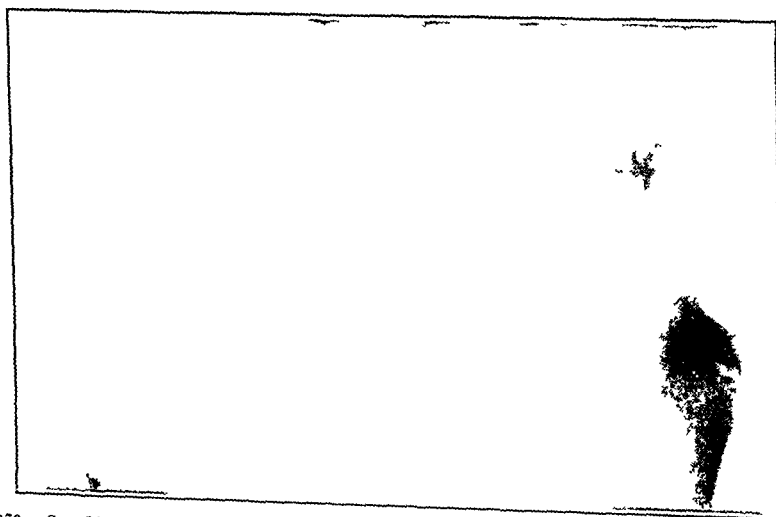
FIG 373.—Case 12 4 years later than in *Fig* 371
Right Hip.—Reconstructed head with uniform opacity   expansion well marked   one third of the head being outside
the acetabulum which shows a sloping roof
Left Hip.—Femoral head is practically restored to the normal

Case 13.—I N female, age 6   Left hip

History and Mode of Onset.—Limp and pain referred to the left hip   Two months' dura-
tion   No trauma

Condition on First Examination, Oct 25, 1920.—Perceptible limp , no pain   Left hip is
adducted and shows considerable limitation of abduction and internal rotation   Trochanter promi-
nent and thickened

X-ray   See Fig 374
Tuberculin and Wasserman tests   Both negative
Rickets   Nil
SUBSEQUENT COURSE —Immobilization in plaster spica after abduction under anæsthesia
No weight bearing for nine months
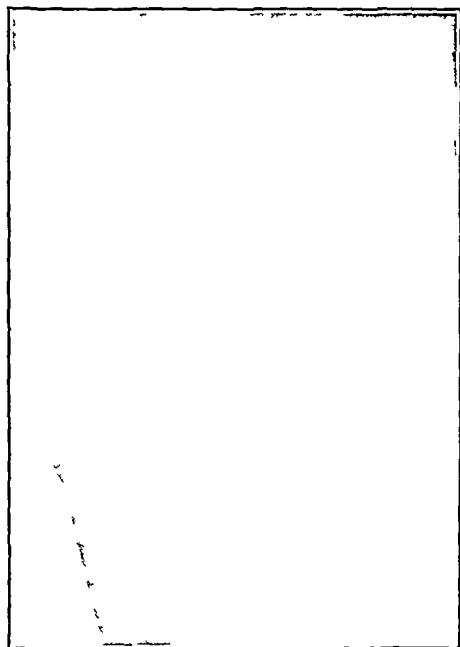
FIG 374 —*Case* 13   I N   Left hip   Period since
onset of symptoms months   Head shows an extreme
type of destruction   with a very irregular contour
Note —Duration of symptoms short
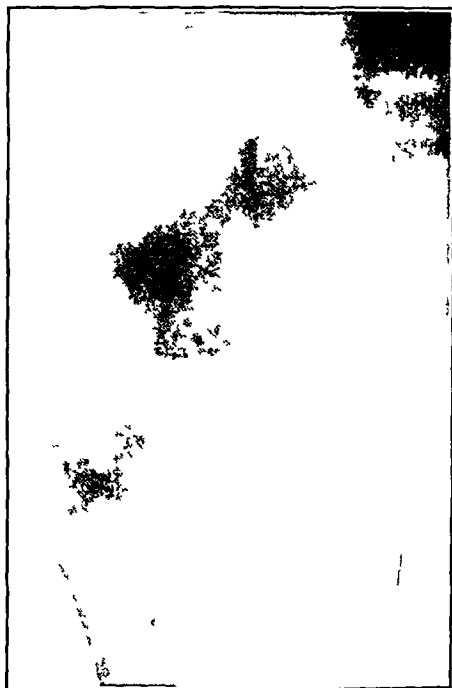
FIG 375 —*Case* 13   9 months later   Shows com
mencing re formation of the fragmented nucleu   the
head is creeping toward the trochanter and the neck
is expanding *pari passu*
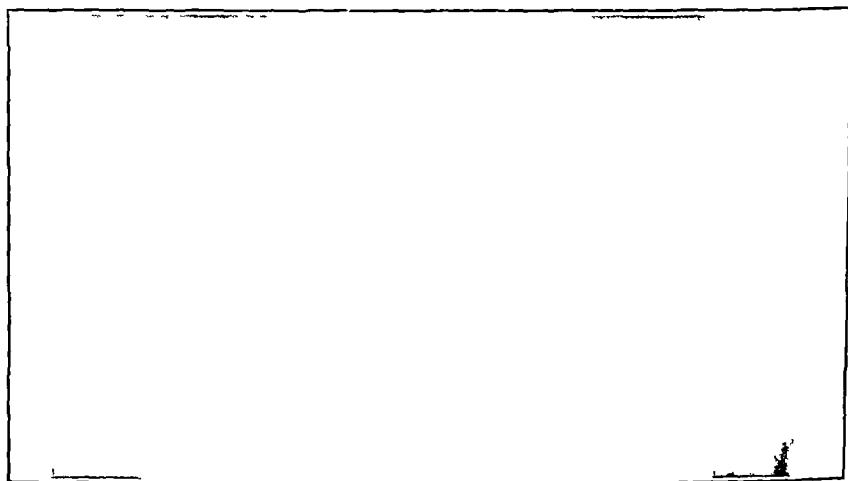
FIG 376 —*Case* 13   S R   Right hip   Period since onset of symptoms month   Head shows very early
flattening   Neck shows slight rounding off with spongy areas in the subepiphyseal region   This represent an early
phase of the cycle of osseous changes associated with a comparatively short duration of symptom

Nov 7, 1921 —Symptomless   Is walking about without any limp   Hip shows limitation
of abduction and internal rotation   Trochanteric thickening is before

X ray   See Fig 375

Comments — Advanced radiographic signs with symptoms of short duration   Reconstruction of the femoral head proceeding

Case 14 — A R , female, age 8   Right hip

HISTORY AND MODE OF ONSET — Pain in hip and knee, limp , no trauma   three months' duration

CONDITION ON FIRST EXAMINATION, Sept 13 1920 — Noticeable limp, trochanter prominent and thickened   Hip fixed in slight *adduction* and flexion by spasm , painless , no local tenderness   General condition of the child is poor

X ray   Head shows crescentic flattening which is marked, and lateral expansion , no fragmentation   Neck is broadened and rounded off

Tuberculin and Wassermann tests   Both negative

Rickets   Slight signs

SUBSEQUENT COURSE — Immobilization in plaster spica after abduction under an anaesthetic , no weight bearing for fourteen months

June 28 1921 — X-ray   Femoral head shows more uniform texture, but its shape is not altered

Nov 7 — Immobilization discontinued   On removal of the plaster the child began to walk about it once with no discomfort and practically no limp   Hip joint shows limitation of abduction and internal rotation, with marked trochanteric thickening

Comments — Duration of observation one year and three months   Changes in the femoral head well advanced, with short duration of symptoms , no evidence of fragmentation stage

Case 15 — S R , male, age 10   Right hip

HISTORY AND MODE OF ONSET — Limp and stiffness in right hip, no pain   History of fall in school gymnasium , this is indefinite   Duration five months
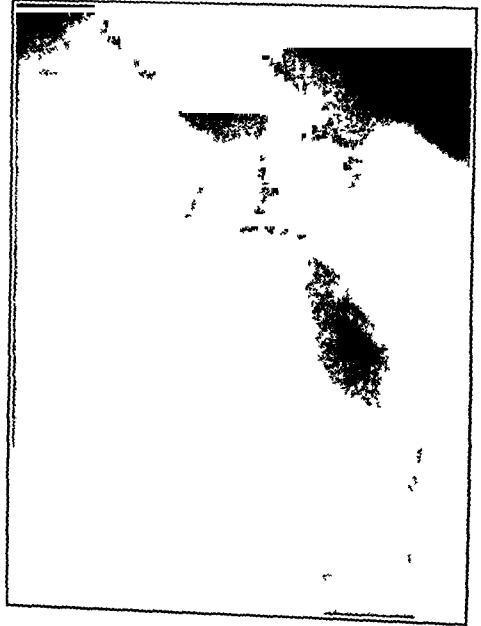
FIG 377 — *Case 14*   17 months later after immobilization and protection from weight-bearing.   Head shows fragmentation change   but with little or no further progress in the direction of flattening

CONDITION ON FIRST EXAMINATION, Sept 6, 1920 — Noticeable limp, with prominence of the right trochanter   Hip is fixed in slight flexion and negative abduction by spasm   Trochanteric thickening , no local tenderness , no atrophy

X-ray   See *Fig* 376

Tuberculin and Wassermann tests   Results not available

Rickets   No signs

SUBSEQUENT COURSE — Immobilization in plaster spica after abduction of hip under anaesthesia   Restriction of abduction was noted during this manœuvre   No weight-bearing for thirteen months

Nov 7, 1921 — Hip joint shows some restriction of mobility in all directions   This sign was noted immediately on removal of the last plaster spica

X-ray   See *Fig* 377

Comments — Duration of observations |fourteen months   After thirteen months'

FIG   *Case 15*   Right hip   Femoral since onset of symptoms
... Head shows advanced flattening, with fragmentation   Neck is broadened
... In the subcapital region a certain pattern like an arrangement of ...
... of condensation and rarefaction
... A very typical example of the dominant of condition changes in pseudo-

Radiographic signs of a slight degree only at the onset of symptoms

immobilization and protection from weight bearing, femoral head shows early fragmentation and enlargement, with a very slight increase in the flattening   In this case the changes are somewhat slow

Case 16 —E S , female, age 6   Right hip
HISTORY AND MODE OF ONSET —Intermittent limp, one year's duration , no pain , no trauma
CONDITION ON FIRST EXAMINATION, June, 1917 —No visible limp   Right hip shows a more prominent trochanter , movements free except for slight limitation of abduction and internal rotation
X-ray   See *Fig* 378
Tuberculin and Wassermann tests   Both negative
Rickets   Stunted child , signs of old rickets
SUBSEQUENT COURSE —Occasional limp noted by parents
April 11, 1921 —Hip joint shows slight residual limitation of abduction and internal rotation Trochanter thickened and prominent as before
X ray   Head of the femur has been restored to uniform density, and its contour is that of a flat crescent
Comments —Duration of observations two years and nine months   Typical pseudo coxalgia occurring in a rachitic child
Special Features —Early radiograms show well defined areas of condensation and rarefaction in the femoral neck which later disappear completely

Case 17 —C S , female, age 13   Left hip
HISTORY AND MODE OF ONSET —Limp noticed for four years   Accurate history not obtainable A recent injury to the left hip has brought the patient to hospital   Onset of symptoms at the age of 9

CONDITION ON FIRST EXAMINATION, Oct 3, 1921 —Left hip fixed by spasm   Motion can be obtained by exerting gentle force   No sign of atrophy , no local tenderness   Trochanteric thickening definite
X ray   Head of femur shows slight flattening with uniform density   The picture is that of healed pseudo coxalgia
Tuberculin and Wassermann tests   Both negative
Rickets   No sign
SUBSEQUENT COURSE —Still under treatment and observation   Temporary immobilization
Comments — Example of recovered pseudo coxalgia with restoration of the head to almost normal   This may be considered to be an abortive type of case

Case 18 —H T , male, age 7   Right hip
HISTORY AND MODE OF ONSET —Limp , pain in the knee following an accident , four months' duration of symptoms
CONDITION ON FIRST EXAMINATION, July 7, 1919 —Noticeable limp , hip is fixed in flexion and *adduction*, and is painless , trochanter is prominent and thickened
X ray   See *Fig* 379
Tuberculin and Wassermann tests   Both negative
Rickets   Faint residual signs
SUBSEQUENT COURSE —Abduction of the hip under anesthesia , immobilization on abduction frame , no weight bearing for three months   After the period of fixation the mobility returned in the hip although the range of abduction remained definitely limited
Dec 15, 1919 —Return of *adduction* contracture , hip is painless , and the boy walks without very much limp
Feb 28, 1921 —Symptomless , no limp   Hip shows limitation of all movements, but only in the extreme ranges
X-ray   See *Fig* 380
Oct 3, 1921 —Limitation of flexion, abduction, and internal rotation only, but very well marked   Trochanteric thickening as before
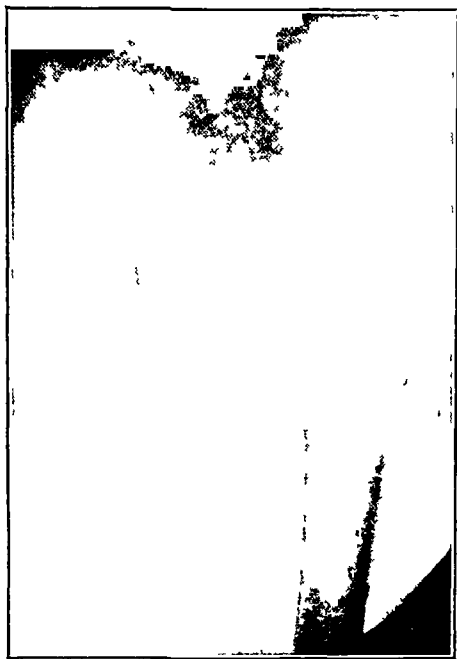
FIG 379 —*Case* 18   H T   Right hip   Period since onset of symptoms   4 months   Head shows well marked flattening   with hypercalcification but with no fragmentation   contour is of an unusual type   Neck is broadened and its metaphyseal end is cupped

A ray   See *Fig* 381

Comments —Duration of observations two years and four months   (During this time the child was examined every month and a complete series of radiograms obtained)

Special Features —The persistence of an unusual amount of limitation of mobility of the joint over a period greater than the average, with a somewhat tardy progression of the radiographic changes towards the stage of restoration of the femoral head
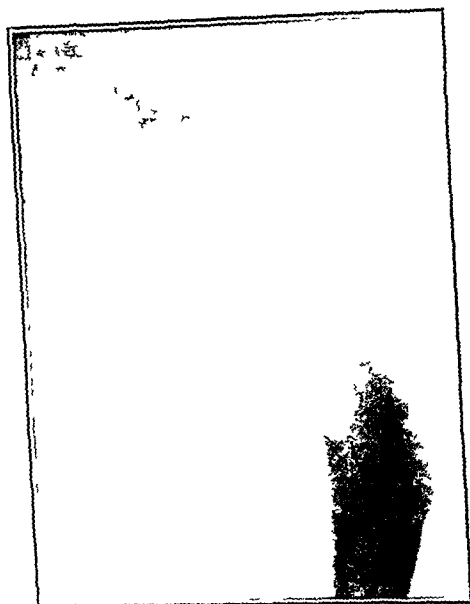
FIG 380 —*Case* 18 1 year and 7 months later Head is now cre-centric and is expanding with evident fragmentation
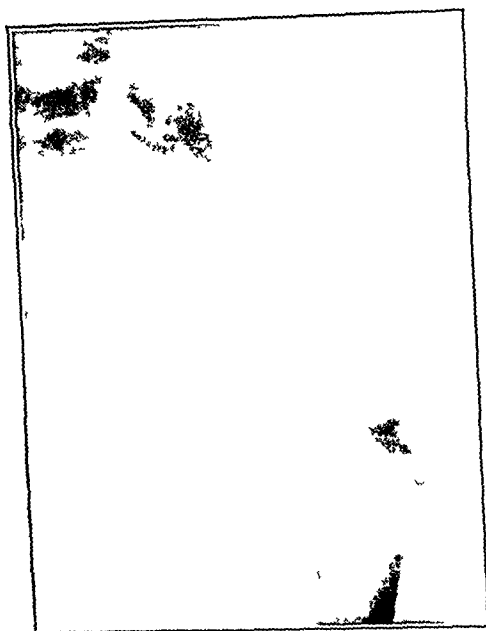
FIG 381 —*Case* 18 2 years and 2 months later than in *Fig* 379 Head shows signs of commencing restoration of its internal structure   Neck is strikingly broadened   two zones of rarefaction almost symmetrical are seen *running down from the epiphyseal line*

Group II —PSEUDO COXALGIA IN ADULT LIFE *

Number of cases, 5   Males, 3 , females 2

Case 19 —J L male age 23   Right hip

HISTORY AND MODE OF ONSET — Hip joint trouble' at the age of 12 , pain in the right hip with limp   Was treated for two years as tuberculous arthritis by immobilization and protection from weight bearing   Made a complete recovery with restoration of function   Joined the army in 1915 and after one years service hip became painful , was discharged in 1917, the condition of the hip joint being rega ' ' ' sability

CONDITION ON FIRST   —Attending hospital as an out-patient owing to the continuance of pain in the right hip , no visible limp , no atrophy of thigh or buttock   The trochanter is a little more prominent than on the opposite side and is definitely broadened in the antero-posterior diameter   The hip is freely movable except in the direction of abduction and internal rotation

* A further example of the probable end result of a bilateral pseudo coxalgia has come under the writer's observation since the completion of this paper   The patient a stunted somewhat obese woman of 35, was known to have been lame since early childhood and compared with her brothers and sisters was always considered to be undersized   Beyond these facts an accurate history was unobtainable   At no time was any treatment directed towards the disability   During the past few years with increasing weight, the hips have become painful and shown an increasing stiffness   Both hip joints showed gross limitation of the range of abduction and internal rotation with elevation of the trochanters which are obviously thickened   The radiograms are reproduced in *Figs* 399 400   The femoral heads appear to conform to that type which we consider represents the adult phase of pseudo coxalgia but the acetabula are so shallow as to recall the appearances seen either in an old reduced congenital dislocation of the hip joint or in those congenital deformities of the hip which represent potential dislocations

X ray   See *Fig* 382

Tuberculin and Wasserman tests   Not available

Comments —An example of the end result of pseudo coxalgia seen in adult life   In this case deformation of the head is of a moderate degree
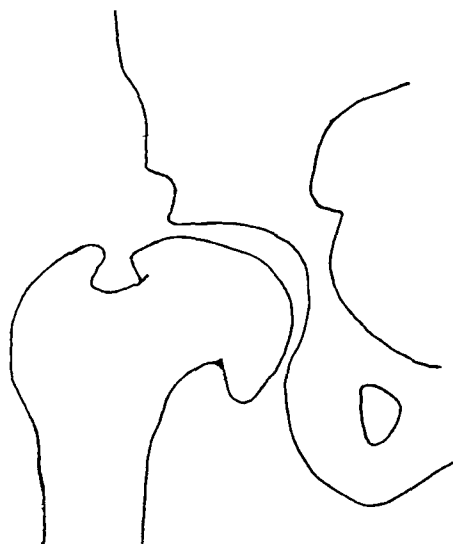
FIG 82 —*Case* 19   J L   Right hip   Trac ing of a radiogram   Deformity of the head of the femur following pseudo coxalgia seen in adult life in a man 23 years of age   Note that the head is too big for the acetabulum

States emphatically that the condition began during war service and followed an injury in 1915 Owing to the development of pain and stiffness of the right hip, patient was invalided out of the service

CONDITION ON FIRST EXAMINATION, Sept 6, 1921 —Attending hospital, complaining of pain and stiffness in the right hip and knee , barely perceptible limp , right hip shows a slight limitation of abduction and internal rotation only , no atrophy, no shortening of the limb , trochanter shows very slight broadening

X ray   See *Fig* 384

Comments —Query, end result of an abortive pseudo coxalgia ?   The radiographic appearances in this case are undoubtedly indicative of a long standing deformation of the head of the femur There are no signs of active hypertrophic arthritis

Case 22 —A W , female, age 42   Right hip

History of hip trouble in childhood , onset at the age of nine   treated by recumbency for two years   has had no reason to complain until three years ago, when the hip became painful Stated to have had recovery with motion in the joint

X ray   See *Fig* 385

Case 23 —Mis B , age 45   Right hip

History of 'hip disease' at the age of seven followed by complete recovery   In 1916 had some trivial accident, since when the hip has given pain, and a limp has appeared

X ray   See *Fig* 386

Case 20 —G F M , male, age 39   Right hip

HISTORY AND MODE OF ONSET —'Hip disease at the age of seven   treated by immobilization and protection from weight bearing for nearly a year Recovery said to have been perfect   No symptoms or disability noted until adult life, when, during military service, the hip became painful and stiff Invalided out of the army in 1917 owing to this condition

CONDITION ON FIRST EXAMINATION   July 1 1920 —Visible limp , limitation of abduction and internal rotation is well marked, with trochanteric thickening and three eighths of an inch shortening of right leg   Hip is painful on forced movements

X ray   See *Fig* 383

SUBSEQUENT COURSE —Pain and stiffness are steadily increasing

March 21, 1921 —Range of mobility in the joint is still further restricted

X ray   No sign of any progressive changes

Comments —Old pseudo coxalgia, with the resulting large flattened head and a small acetabulum Onset of symptoms under conditions of strain , the probable commencement of a superadded hyper trophic arthritis

Case 21 —J R   male, age 35   Right hip

HISTORY AND MODE OF ONSET —No history of hip joint trouble in childhood or in adolescence

FIG. 282.—Case 20. C. L. M. Right hip. The
end result of a recovered pseudo coxalgia seen in a
man of 59. The head is relatively enormous and is
flattened. It lost one third of its circumference -
external to the acetabular cup.
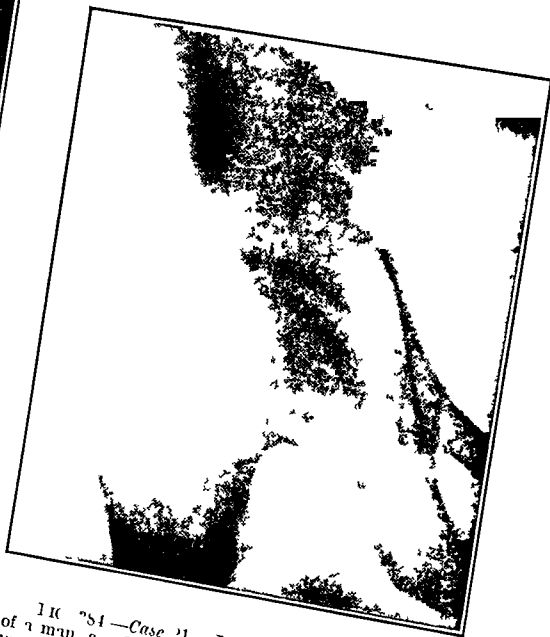
FIG. 284.—Case 21. J. R. Right hip. Hip joint
of a man age 35, with no history of hip joint trouble
in childhood or adolescence. The deformed femoral
head closely resembles that seen in the preceding figure
but the alteration is not as conspicuous. This is most
probably the end result of an abortive pseudo coxalgia.

FIG. 285.—Case 22. A. W. Right hip. Hip joint
of a woman age 34, with a history of complete
recovery of hip disease in childhood. Onset of pain
and stiffness in later life. The head of the femur is
enlarged and mushroomed. The articular surface is
irregular and the whole picture is indicative of upper
femoral arthritic changes. (From the collection of Dr.
J. W. H. Morison.)

FIG. 286.—Case 23. M. P. Right hip. Hip joint
of a woman age 15, with a history of cured hip disease
in childhood. Onset of limp and pain in later life
following an injury. The femoral head is expanded
and mushroomed out. Partial subluxation is present.
(From the collection of Dr. J. W. H. Morison.)

Group III —ARTHRITIS DEFORMANS JUVENILIS COXÆ

Number of cases, 5   Males, 5 , females, nil

Case 24 —J H , male, age 14 bilateral affection

HISTORY AND MODE OF ONSET —Limp followed alleged injury to *left* hip , duration three months

CONDITION ON FIRST EXAMINATION, Oct 18, 1915 —*Left* hip fixed by spasm in flexion and *adduction* , condition practically painless   Radiographic examination at this time was unsatisfactory, and no accurate record is now available amongst my notes   A tentative diagnosis of early tuberculous arthritis was made, and accordingly the hip was immobilized in a plaster spica after abduction under an anæsthetic   The limitation of abduction was noted at this time, even with complete muscular relaxation, but its significance was overlooked

SUBSEQUENT COURSE —Patient was lost sight of for nearly two years

Aug 19, 1918 —Reported at the hospital , states that the plaster spica applied in 1915 was taken off at home at the end of six weeks ; has worked since that time and considers that the left hip has recovered   Now complains of pain in the *right* hip
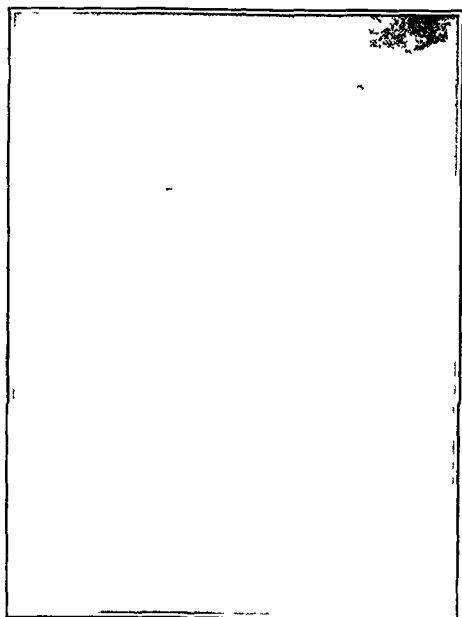
FIG 357 —*Case* 24   J H   Left hip   Diagnosis bilateral arthritis deformans juvenilis   Period since onset of symptoms   3 years   Head of femur is mushroomed out and its contour almost unrecognizable   The joint cavity it elf shows partial obliteration
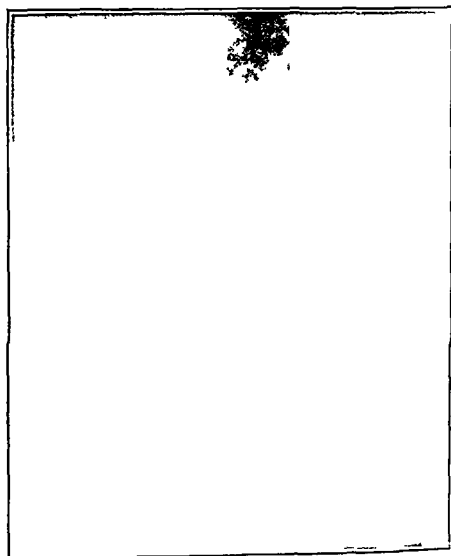
FIG 358 —*Case* 24   Right hip   Period since onset of symptoms 4 years   The femoral head is distorted and mushroomed   the articular surfaces are less affected than on the opposite side

Left hip fixed in moderate flexion and *adduction* , no mobility can be obtained , condition is painless   trochanter is elevated and prominent , there is visible slight atrophy of the thigh and buttock   *Right hip* shows limited flexion, abduction, and internal rotation , other motions are free

X-ray   See *Figs* 387, 388

Tuberculin and Wassermann tests   Both negative

Rickets   Slight residual signs

Patient again lost sight of , returned once more still complaining of pain and limp

April 25, 1919 —Examination under an anæsthetic   *Right hip* shows full mobility except for range of abduction   *Left hip* shows gross limitation of motion in all directions

Immobilization on an abduction frame for eight months   at the end of this time the patient discharged himself and returned to work

Aug 23, 1920 —H is worked as an ordinary labourer , no pain in either hip

Right hip shows gross limitation of abduction and rotation, both external and internal , trochanter very prominent   *Left hip* shows limitation of flexion abduction, and internal rotation , trochanter thickened and elevated

March 7, 1921 —Working now as a blacksmith s striker , still without symptoms   States

that recently he enlisted in the regular army was passed as fit, but in a few weeks was reclaimed by his parents as being under age No limp or pain *Right hip* shows flexion limited to 90° abduction half of normal range, internal rotation practically nil, external rotation slight range only *Left hip* shows more mobility than the right,

FIG 389 —*Case* 24 Left hip 2 years and 4 months later than in Fig 387 Femoral head now shows more definite outline but the mushroom deformity is still present no ankylosis Head is not enlarged when compared with acetabulum
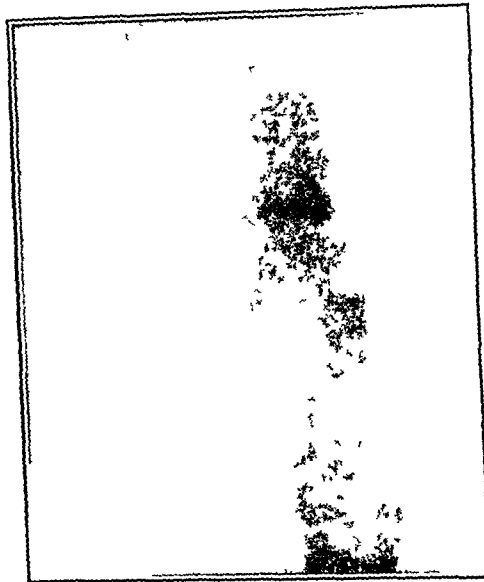
FIG 390 —*Case* 24 Right hip 1 year and 7 months later than in Fig 388 Femoral head is flattened out, and slightly larger than acetabulum

limited flexion abduction, and internal rotation Fine grating is palpable during motions of the joint Both trochanters are elevated, the right being definitely broader than the left There is no conspicuous muscular atrophy, but the left buttock and thigh are less well developed than the right side Left leg is half an inch shorter than the right

X-ray See *Figs* 389, 390

Case 25 —G H B , male, age 32 Right hip
HISTORY AND MODE OF ONSET —Pain and stiffness in the right hip beginning at the age of fifteen He has attended various hospitals intermittently the hip joint has never been immobilized or protected from weight-bearing Hip is constantly painful and he is unable to continue at heavy work

Aug 23 1921 —Very little limp in walking Right hip shows marked limitation of flexion, abduction, and internal rotation Trochanter is thickened and prominent The limb is underdeveloped as a whole, but the degree of muscle atrophy is slight, and it is not localized to the buttock and thigh

X-ray See *Fig* 391

Wassermann test Negative

Case 26 —J M , male, age 22 Left hip
HISTORY AND MODE OF ONSET —At the age of sixteen sudden onset of pain in the left hip and knee no history of trauma Attended a hospital where tuberculous arthritis was diagnosed and the hip immobilized and protected from weight-bearing for a period of eight months Said to have made a complete recovery with mobility

FIG 391 —*Case* 25 G H P Right hip Diagnosis arthritis deformans juvenilis The joint shows advanced change in the femoral head 17 years after the onset of a type of non tuberculous arthritis The head is flattened and expanded and the acetabular margin shows hypertrophic changes

Joined the army in 1916 and served until September, 1919, complained of pain in the hip and knee after a very short period of war service

CONDITION ON FIRST EXAMINATION, May 8, 1920.—Reported owing to increasing pain and stiffness in the left hip, hip shows limitation of flexion, abduction, and internal rotation, troch anteric thickening is marked, fine grating is present in the joint on movement. Very slight under development of thigh, buttock, and calf as compared with the opposite side

X ray. See *Fig* 392

SUBSEQUENT COURSE.—Treatment by abduction of the hip under an esthesia, the shortening of the adductors necessitated a forcible stretching before full abduction was obtained, immobiliz a

FIG 392.—*Case* 26. J M. Left hip. Diagnosis arthritis deformans juvenilis. Period since onset of symptoms 6 years. Head of femur shows a striking deformation with mushrooming and lipping of the articular margin. similar hypertrophic changes are seen in the acetabular roof

tion on an abduction frame, after three months fixation, partial weight bearing was allowed in a walking caliper splint

Sept 1, 1921.—Hip is becoming painful again, now shows signs of progression towards the stage of ankylosis, all motions are restricted

X ray. Further mushrooming of the femoral head is evident with irregular changes in the articular surfaces. The appearances suggest pro gressive arthritis

Case 27.—J D, male age 23. Right hip

HISTORY AND MODE OF ONSET.—At the age of seventeen was treated for hip disease, the pain and limp lasted for some months, but full recovery ensued. Joined the army in 1916, invalided out in 1919 owing to trouble in the hip

CONDITION ON FIRST EXAMINATION, Novem ber, 1920.—Still complains of pain and stiffness in the right hip joint. Hip shows limitation of abduction and internal rotation, no atrophy, no shortening

X ray. The head of the femur shows slight mushrooming and is too large for the acetabulum

SUBSEQUENT COURSE.—Treatment by immobi lization on an abduction frame for nine months, followed by partial weight bearing in a caliper splint

Nov 23, 1921.—Hip joint shows increasing restriction in its range of movement

X ray. Shows further irregularity and mush rooming of the head, the condition is progressing towards ankylosis

Case 28.—F R, male, age 16. Right hip

HISTORY AND MODE OF ONSET.—Pain in hip, limp, no trauma, eight months' duration

CONDITION ON FIRST EXAMINATION, Nov 2, 1914.—The left hip shows an adduction con tracture marked limitation of abduction and of internal rotation, other movements present Fine grating on movement no atrophy, trochanter prominent and thickened

X ray. The head of the femur is slightly expanded and shows a very early mushroom deformity, the appearances are in every way similar to those seen in *Case* 27. The femoral neck appears to be slightly shorter than on the opposite side

Tuberculin and Wassermann tests. Both negative

Rickets. No signs

SUBSEQUENT COURSE.—Treatment by immobilization in plaster spica after manipulation of the hip into abduction, weight bearing continued. Patient was ultimately lost sight of for three years

June 18 1917.—Reported for examination after being requested to visit the hospital. Slight limp no pain hip is now ankylosed in slight flexion and negative abduction, trochanter thickened and prominent, slight atrophy of the thigh and buttock, shortening three eighths of an inch

X ray. No records are now available

Patient was called up for military service early in 1918 and employed for a time as a motor transport driver. The hip continued to give trouble

June 11 1918.—On examination hip was found to be fixed in slight flexion and abduction Ankylosis feels firm but not bony. Shortening three quarters of an inch

X ray. Shows further mushrooming of the head, slight lipping of the acetabulum. No bony ankylosis present
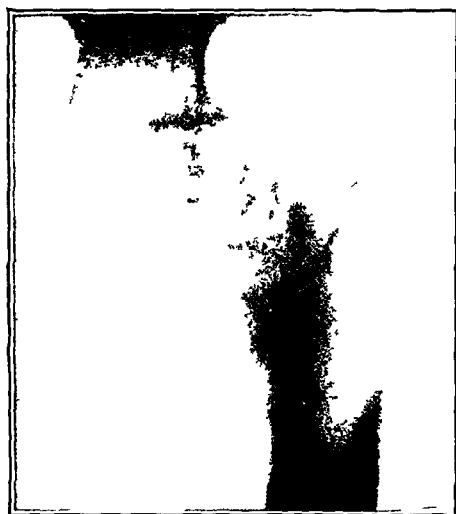
Group IV—COXA PLANA, FLATTENING OF THE HEAD OF THE FEMUR IN MISCELLANEOUS CONDITIONS

Chronic osteomyelitis of the neck of the femur (tubercle) 3 Tuberculous arthritis of the hip joint, 2 ; Post-scarlatinal arthritis of the hip-joint, 1 ; Congenital dislocation of the hip joint (bilateral), 1

Case 29 —L. T., female age 6 Right hip

DIAGNOSIS — Tuberculous osteomyelitis of neck of femur

HISTORY AND MODE OF ONSET —Pain and limp beginning at the age of three treated as tuberculosis of the hip joint by immobilization and protection from weight bearing for two years Abscess developed at the end of two years, this was evacuated, closed healed by first intention

CONDITION ON FIRST EXAMINATION, March 16, 1918 — Slight limp no pain The hip shows definite limitation of abduction, other motions free Scar of old operation visible on lateral aspect of joint Trochanter is slightly
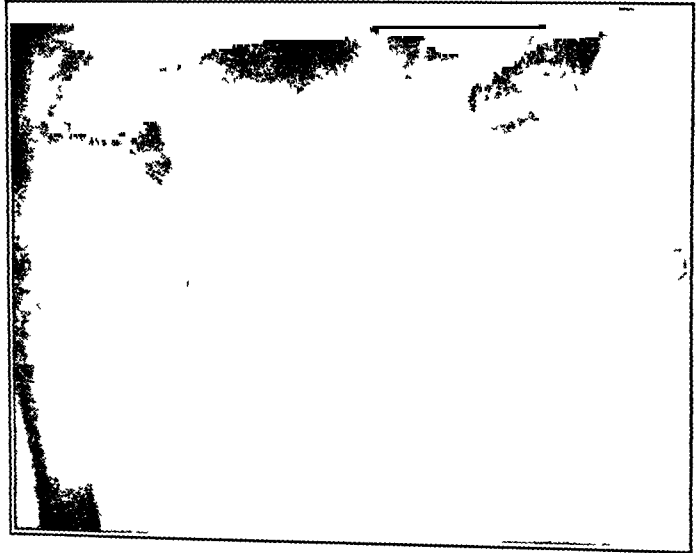
FIG 393—*Case 29* L T Right hip Diagnosis tuberculous osteomyelitis of the femoral neck—coxa plana Period since onset of symptoms , years Neck of femur shows an elongated focus of rarefaction extending from its base to the epiphyseal line this area is walled off by a thin zone of condensation Head of femur shows moderate flattening and slight expansion its internal structure is unchanged

thickened , very slight atrophy of buttock and thigh The joint shows fine grating on movement There is practically no disability

X ray See *Fig* 393

Tuberculin test *Strongly positive*

Wassermann test Negative

SUBSEQUENT HISTORY —Examined repeatedly over a period of nearly four years No return of symptoms Physical signs unchanged Child is leading a normal active life

Aug 8, 1921 —X ray See *Fig* 394

Comments — Duration of observation three years and eight months Osteomyelitis of the femoral neck , evidence strongly in favour of tuberculosis associated flattening of the femoral head with the production of a 'cap' type of deformity Spontaneous healing of the focus of osteomyelitis can be traced in the large series of radiograms in the writer's possession

Case 30 —A M , female, age 7 Left hip

DIAGNOSIS —Osteomyelitis of femoral neck (tuberculous)

HISTORY AND MODE OF ONSET —Onset at the age of four , pain in hip and knee with night cries History of vague trauma Treated as tuberculous arthritis of the hip for two years by immobilization and protection from weight bearing

CONDITION ON FIRST EXAMINATION, April 8 1918 —No pain, but slight limp persists All movements at hip joint are restricted in the extreme ranges , trochanter is thickened and prominent No perceptible atrophy of buttock or thigh at this date There was definite fullness with deep fluctuation palpable in Scarpa's triangle

FIG 394 *Case 29* , years and 4 months later The focus of osteomyelitis has undergone almost complete healing The flattened head is too far over the acetabulum

X ray   In the neck is seen a long tortuous cavity extending from the subepiphyseal region almost to the base of the neck, neck is thickened   The head of the femur shows a 'cap like flattening   The picture resembles very closely that seen in *Fig 396*

Tuberculin test   Strongly positive

Wassermann test   Negative

Subsequent Course —The swelling over the hip disappeared spontmeously after two months' immobilization

June 14, 1920 —Child is attending an ordinary school, and has had no return of symptoms Right hip shows very little restriction in mobility except in the extremes of abduction, trochanteric thickening is before

X ray   The focus in the neck of the femur is undergoing obliteration, flattening of the head is before

Comments —Tuberculous osteomyelitis of neck of femur, secondary coxa plana

Case 31 —A S, male, age 3   Right hip

Diagnosis —Tuberculous osteomyelitis of femoral neck, tuberculous arthritis of hip joint

History and Mode of Onset —Insidious limp, painless, no trauma, duration two months

March, 1915 —Hip fixed by spasm in slight flexion and abduction, atrophy of thigh and buttock visible   trochanteric thickening slight

X ray   Appearances considered to be indefinite, no records preserved

Fig 311 —Case 31   A S   Right hip   Diagno is   tuberculous osteomyelitis of the femoral neck—coxa plana Period since on et of symptoms   3 years   Accl shows osteomyelitic changes extending up to the epiphy eal line   Head is slightly flattened and shows early di integration

Treatment by immobilization in a short plaster spica   Patient was lost sight of for nearly two years

Subsequent Course —Dec 3, 1917 —Is limping badly, but has no pain   Hip is fixed by spasm with physical signs as before

X ray   Shows a focus of osteomyelitis in the neck of the femur, slight flattening of the head of the femur (*Fig 395*)

Tuberculin test   Positive

Wasserman test   Negative

Feb 11 1918 —Child reported with swelling over the front of the hip, deep fluctuation was evident with distended veins overlying

Treatment by immobilization on an abduction frame

July 13 1920 —Still immobilized, abscess more prominent   Operation   evacuation and closure of typical tuberculous abscess

X ray   Shows complete destruction of the head of the femur and excavation of the acetabulum with marked bone atrophy

Comments —Primary tuberculous osteomyelitis of the neck of the femur with an associated flattening of the femoral head in the earlier stages, progressive destruction leading to complete disappearance of the head and extensive disorganization of the joint by the continued invasion of the tuberculous process

Case 32 —R B , male, age 5   Right hip
DIAGNOSIS —Tuberculous arthritis of the hip joint
HISTORY AND MODE OF ONSET —Acute pain in right knee and hip of six weeks' duration , six months' history of noticeable limp

CONDITION ON FIRST EXAMINATION Jan 11 1921 —Right hip is fixed in 60° flexion by spasm is acutely painful and child looks very ill   Thickening of the soft parts overlying the joint is present, but there is no evidence of deep fluctuation , trochanteric thickening noticeable , muscular atrophy well marked

X ray See Fig 396
Tuberculin test   Positive
Wassermann test   Negative

Oct 10, 1919 —Readmitted to hospital with an obvious deep abscess which was aspirated Pus sterile , contained caseous material typical of a tuberculous abscess

Comments —Flattening of the femoral head, with commencing disintegration, in the early stages of tuberculous arthritis of the hip

Case 33 —E J , male, age 8
DIAGNOSIS — Tuberculous arthritis of right hip Coxa plana left hip

HISTORY AND MODE OF ONSET —Pain in the right hip beginning at the age of two   Treated by immobilization on a double Thomas splint for five years No symptoms referable to the left hip,

CONDITION ON FIRST EXAMINATION, June 1916 —Noticeable limp   Right hip is ankylosed in marked flexion and adduction   atrophy of buttock and thigh   No abnormality noticed at that time in connection with the left hip   Correction of adduction deformity by operation

March 3, 1919 —Right hip shows solid ankylosis   Shortening, one and three quarter inches Left hip, examined as the result of the radio
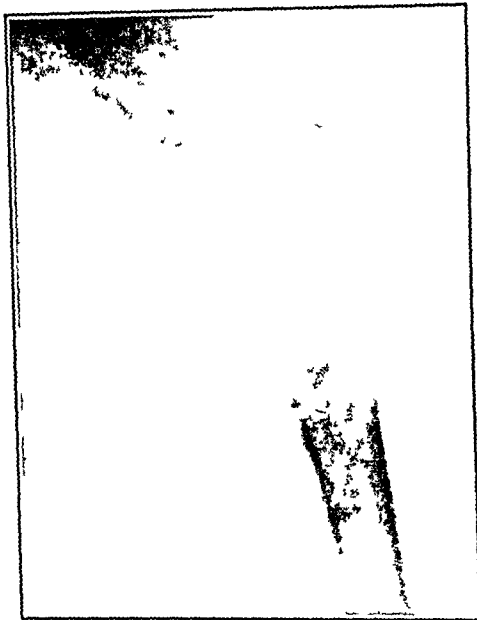
FIG 396 Case 32 R B Right hip Diagnosis tuberculous arthritis of the hip joint   Head of femur shows moderate flattening with cysts of integration, and the neck shows a cupping of the metaphysis

The picture is not unlike that seen in Fig 382, which is a true pseudo coxalgia   But note the existence of marked bone atrophy the general haziness of the bone shadows and the excavated acetabulum   These signs are pathognomonic of tuberculosis
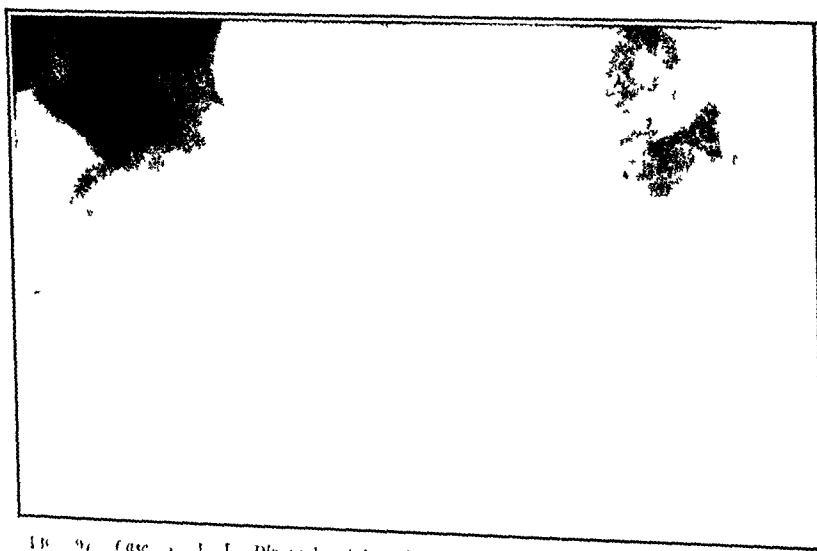
FIG 397 Case 33 E J Diagnosis tuberculous arthritis of right hip, Coxa plana of left hip
Right Hip Bony ankylosis following healed tuberculous arthritis
Left Hip Large flattened femoral head, with hypertrophied neck

graphic appearances shows slight limitation of abduction and flexion
X ray See Fig 397
Comments   Coxa plana deformity of unknown origin in the opposite hip to that which is the site of a tuberculous arthritis   This is possibly an abortive type of true pseudo coxalgia

Case 34 — J H male, age 6

DIAGNOSIS —Post scarlatinal arthritis of both hip joints *Left hip* ankylosis *Right hip* coxa plana

HISTORY AND MODE OF ONSET —During the course of an attack of scarlet fever in acute arthritis developed in both hips, the left knee, left shoulder, and left temporomaxillary joint, suppuration occurred in the knee only

CONDITION ON FIRST EXAMINATION, June, 1915 —*Left hip* ankylosed in flexion and adduction with gross deformity *Right hip* was noted to have a slight restriction of mobility at the time, but accurate records of this are no longer available

Adduction deformity corrected by operation in July, 1915

SUBSEQUENT COURSE —Feb 28, 1921 —*Left hip* firmly ankylosed in slight abduction *Right hip* shows limitation of abduction and internal rotation, trochanteric thickening is present In spite of the bony ankylosis of the left hip and the restricted mobility of the right hip, the boy walks with surprisingly little limp

X-ray *Left hip* shows bony ankylosis *Right hip* shows moderate flattening of the head of the femur which is slightly mushroomed, irregular acetabular changes are present

Comments — Coxa plana following acute infective arthritis of the hip joint
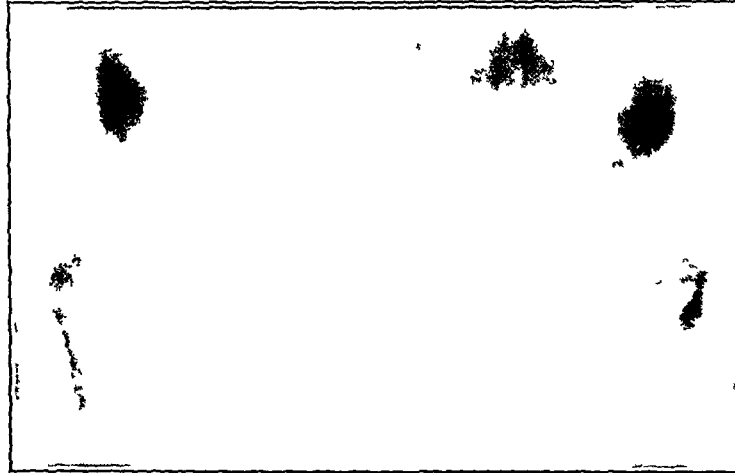
FIG 98 — *Case 34* J K Double congenital dislocation of the hip 5 year after reduction *Left Hip* —Shows a flattened femoral head with a deformity resembling that seen in a pseudo coxa vara

Right Hip —A similar type of flattening is seen on this side but is less evident in the picture owing to the position of the hip

Case 35 —E K female, age 9

DIAGNOSIS — Double congenital dislocation of the hip

HISTORY —Reduction in 1916 Some difficulty was experienced with the left hip, which re dislocated but was reduced a second time

Aug 8, 1921 — X ray See *Fig* 398

Comments — In the complete series of radiograms illustrating this case there was no stage at which any fragmentation changes were noted in the femoral epiphysis on either side
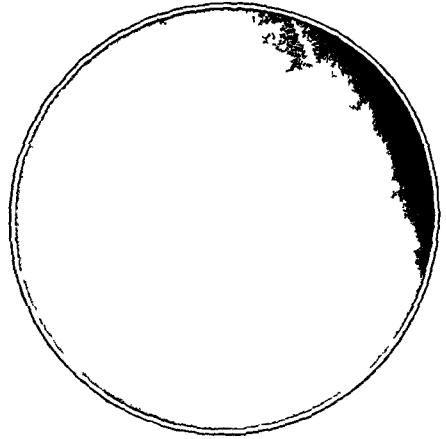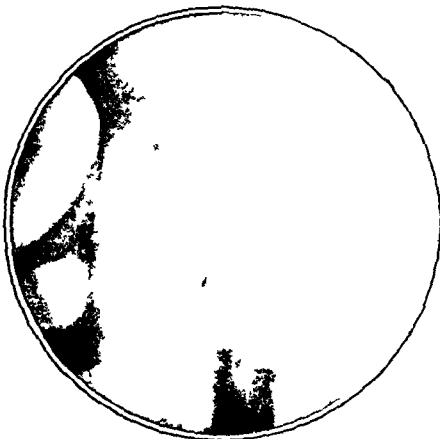
FIG 100 — The left hip of the patient illustrated in *Fig* 99 the similar appearances of the femoral head

See footnote p 381

SYMPTOMATOLOGY, PHYSICAL SIGNS, AND RADIOGRAPHIC APPEARANCES

SYMPTOMATOLOGY AND PHYSICAL SIGNS

For the purposes of description we may recognize three clinical stages with purely arbitrary limits (1) *The Stage of Onset*, (2) *The Active Stage*, and (3) *The Stage of Recovery*

1 **The Stage of Onset** —The initial symptoms are such as characterize the ushering in of a mild synovitis of the hip-joint, and may arise insidiously or acutely

Limp —This is the most constant early sign, but may be unnoticed for some time, unless accompanied by pain The limp of pseudo coxalgia is also typically intermittent

Pain —The frequent absence of pain has been commented upon by most writers, but this is by no means an invariable rule Thus in 9 out of the 18 cases of pseudo coxalgia included in the first group of my series, pain referred to the hip joint, or to both hip and knee, was a prominent feature, and in one case was of sufficient intensity to be regarded as equivalent to night cries (*Case* 1) Sundt[15] found that 20 cases out of 66 gave a history of pain referred to the knee In the original paper of Perthes this feature was recorded in 50 per cent of the cases

Pyrexia —The not infrequent existence of slight pyrexia in the early stages has been commented upon by various authors Sundt in particular recognizes a febrile type but he considers this to be quite atypical It is exceptional in this disease to be able to observe and treat the children as hospital in-patients, so that few observations have been made in this connection In two cases in my own series (*Cases* 1 and 8) who were by chance under my care for some time in a country hospital, an irregular pyrexia was noted

Muscular Spasm —It is likely that in most cases there is a stage during which the hip is completely fixed by muscle spasm, just as in the onset of true arthritis Many cases are not examined in this phase, so that in the symptomatology recorded the occurrence of total spasm has often been minimized Calve regarded the stage of spasm as common to all cases This has also been noted by others, and in particular by Schwartz and Delitala[18] In my own series it will be seen to have been recorded in 7, all of which were examined soon after the development of subjective signs In these cases the hip-joint was absolutely immobile for the time being

2 **The Active Stage** —We cannot define the limitations of the so called active stage except in conjunction with a study of the radiographic changes, but this period may be said to extend from the time of the appearance of the first subjective or objective phenomena to the stage at which the manifestations are so trivial as to give rise to the belief that recovery has taken place The duration of this stage varies from about six to eighteen months

Limp —The limp which appeared at the first onset of symptoms shows a steady tendency to disappear, but may return from time to time for short periods, and occasionally may continue indefinitely In my own observations the limp has proved to be an inconspicuous feature at all periods, except during the temporary existence of local pain and tenderness or complete fixation of the affected joint

Spasm —The spasm of the stage of onset lasts but for a very short time, usually disappearing spontaneously and leaving a residual limitation of mobility It is interesting to note that spasm may reappear during the course of this stage, subsiding once again (*Case* 18) The spasm invariably outlasts the pain and tenderness, and the child may be found limping with a completely fixed hip which is quite painless When the hip-joint is found on examination to be fixed in this manner, the position is often one of slight flexion combined with *adduction* This is in striking contrast to the abducted position of the early tuberculous hip joint and constitutes a sign of diagnostic importance

Mobility of the Hip joint —During the whole of the active stage, apart from the period of spasm the affected hip joint invariably shows a limitation of the range of abduction and internal rotation, and less commonly of flexion This physical sign is often a conspicuous one The restriction is dependent on a combination of factors—viz localized

spasm of the adductor group of muscles, true shortening of the adductors, and, in the later stages, the actual mechanical changes in the joint due to the deformation of the femoral head   It was first noted by Perthes that the limitation 'of abduction persisted under anæsthesia   This has been confirmed by others, and is fully borne out in my own series, being recorded in 6 out of the 18 cases in *Group I*   Sundt, on the other hand, states quite definitely that under an anæsthetic there is no restriction of the mobility of the hip

Trochanter   Position and Alterations—One of the outstanding signs is the prominence of the trochanter on the affected side   This bony landmark is seen to project unduly in the lateral direction

The question of its level, in relation to Nélaton s line, is a vexed one   Calvé, in his original series of cases, found that elevation of the trochanter existed in accordance with the radiographic manifestations of an early degree of coxa vara deformity   Very slight elevation is recorded as a common sign also by Legg and Perthes, but by other writers little stress is laid on this sign, owing probably to the inherent difficulty of appreciating very small differences in level *   In my own series a careful scrutiny has failed to establish the presence of any alteration in the level of the trochanter   The prominence of the trochanter is, however, indicative of a definite antero-posterior broadening, and is also a key-note to the changes which have occurred in the neck of the femur   Trochanteric thickening is a sign present at every stage in the life history of a case of pseudo coxalgia, and in my own clinical records the constancy of this sign is striking

Calvé, in his original paper, also emphasized the ease with which the femoral head could be palpated in Scarpa s triangle , but this sign has received little attention in the subsequent literature   In one case only in my own series was this feature present

Muscular Atrophy—The lower limb on the affected side is always found to be slightly under-developed as a whole when compared with its fellow, but a conspicuously visible and localized muscular atrophy involving the buttock and thigh, with loss of the gluteal fold, which is a constant sign in tuberculous arthritis of the hip, is never seen in cases of pseudo coxalgia

Shortening—It is generally admitted that shortening of the limb is rare, or, if present, of a barely appreciable amount   Its existence would indicate the occurrence of true destruction of the joint elements, or the development of a coxa vara deformity   These sequelæ are non existent in pseudo coxalgia during childhood , although in these patients unnoticed extension of the deformity of the femoral head in later life may produce recognizable shortening

Although as we shall see, the recognition of pseudo coxalgia largely depends on radiography yet, given a particular combination of physical signs in the absence of certain other signs a tentative clinical diagnosis should not be outside the bounds of possibility We may stress again the typical picture   symptoms of recent origin referred to one hip , a hip joint fixed completely by spasm in the position of *adduction* , undue prominence and palpable thickening of the trochanter , the complete absence of local tenderness, swelling or muscular atrophy   At the same time it must be admitted that an almost identical syndrome may be seen at one stage in certain types of coxa vara, or in cases of extra articular tuberculosis of the hip   The whole picture, however, is the complete antithesis of that provided by early tuberculous *arthritis* of the hip-joint

3 **The Stage of Recovery**—With the steady diminution in intensity of subjective and objective signs appears the stage reached by all cases of pseudo coxalgia—the stage of apparent recovery with the preservation of function in the hip-joint   With the final disappearance of any perceptible limp, we can appreciate the existence of any residual signs only after careful physical examination   It may be confidently stated that with the exception of the rare abortive or unusually mild types, in all cases of pseudo coxalgia two signs at least appear to persist throughout life, viz   trochanteric thickening and a limitation of the range of abduction

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* Prior r- found that in 40 per cent of all individuals the trochanter is slightly above Nélaton s line and as a general rule its level is of no diagno tic value

RADIOGRAPHIC MANIFESTATIONS

Since the first recognition of pseudo coxalgia as an entity, it has been realized by all concerned that the radiographic signs are of a very special and interesting type. In a joint lesion where the clinical signs are relatively transient, and where recovery with restoration of almost normal function is seen as a routine, opportunities for the inspection of the pathological changes in the living have of necessity been almost totally lacking. Thus every hypothesis which has been brought forward concerning the etiology and nature of pseudo coxalgia has been founded primarily on a study of the osseous changes seen in skiagrams of the hip joint.

It is evident that a definite cycle of osseous changes occurs in the majority of cases if not in all, and although out of the considerable number which have been reported in the literature there have been comparatively few in which the whole gamut of changes has been followed, we are in a position to reconstruct the cycle and define its component manifestations with some degree of certainty.

It has been stated already that the radiographic changes peculiar to this disease consist in brief in the development of a distortion of the head of the femur, which becomes flattened out and in a broadening and stunting of the femoral neck. But associated with these gross deviations of contour are certain finer transformations of the internal bony architecture. We may proceed now to analyze in greater detail the varied phases which make up the whole cycle, and which are all illustrated in the radiographic observations reproduced here from my own material.

Changes in the Femoral Head —

1. *Flattening* —The earliest change is simple flattening, the head being slightly reduced in its vertical diameter but with little or no appreciable enlargement in the lateral direction (see *Figs* 357 and 376). At this stage the bony nucleus shows a uniform opacity, but a little later it may show those signs of irregular calcification which denote the commencement of the next phase.

2. *Further Flattening with Fragmentation* —The term 'fragmentation' is conveniently applied to the picture afforded by the apparent breaking up of the bony nucleus of the epiphysis into a number of pieces. There seems to be no one pattern in this fragmentation, the size and number of the bony 'islets' vary considerably. The condensation of lime salts into these fragments produces a characteristic radiographic appearance of hypercalcification in the flattening head as compared with the femoral head of the opposite hip.

Coincident with these dissolution changes, the head is seen to become still more flattened, and is now expanding and, as it were creeping out of the acetabulum in the direction of the great trochanter. The attenuation of the head may reach a stage in which it is represented by a thin strip of condensed tissue only (see *Fig* 378).

The fragmentation may be of so bizarre a type as to give the impression of the imminence of a complete breaking up and disappearance of the head (see *Fig* 374). In *Fig* 371 (left hip) definite fragmentation of the inner third of the epiphysis is seen without any advanced alteration in the contour of the head as a whole. But this is to be considered in its typical form, and it is noteworthy that in this particular hip a restoration occurred which represented almost a return to the normal (see *Fig* 373).

3. *Flattening with Fusion Changes in the Disorganized Nucleus* —This may be considered as an initiation of the 'healing' stage. The bony islands gradually coalesce, and the density of the epiphysis is ultimately diminished until its opacity is not only uniform but is equivalent to that seen on the opposite side. The head, however, remains flattened and continues to progress in the direction of lateral expansion, assuming a cup like form with a considerable part of its circumference external to the line of the acetabular margin (see *Figs* 365, 366, 372, 373, 374, 375, 381).

Thus whilst the internal structure of the epiphysis is being restored its contour demonstrates the continued extension of a progressive deformation.

4. *The Expanded Flattened Head* —With the completion of the reconstruction stage the head shows a deformation which we believe persists throughout life, except in those

rare cases where a restoration of contour has occurred *pari passu* with the restoration of the internal structure of the epiphysis (e g , *Case* 15 in my series)

As evidence of this view may be presented the little group of 5 cases which I regard as depicting the condition of the hip-joint of pseudo coxalgia in adult life (*Group II*) The large, expanded, flattened head which is too large for the acetabulum shown in *Figs* 382, 383, 384, is exactly comparable to the flattened head seen after some years in those children with undoubted pseudo coxalgia where the preceding changes have been observed and placed on record (see *Figs* 363, 366 373)

The question arises at this juncture as to whether every case of pseudo coxalgia exhibits all the phases described above It is generally agreed that this is the ordinary course of events , but Brandes,[20] from observations conducted over a period of years in a series of 17 cases, has recognized two distinct groups (1) Where the head becomes fragmented and later on shows fusion, but remains flattened , and (2) Where the head undergoes flattening without any fragmentation In this latter group it is stated that a restitution to the normal may be seen finally The correctness or otherwise of this view is both difficult to establish or to criticize from independent investigations, as the proof of the existence of the second group necessarily rests on the possession of such a complete series of radiograms in each case as would exclude the possibility of the appearance of fragmentation having been overlooked

In this connection one case in my series may be stressed (*Case* 14) in which after a short period of symptoms—three months—the radiographic changes in the head were far advanced as regards flattening, but the structure of the epiphysis exhibited the appearance usually considered to be typical of the completed fusion phase In this case during a subsequent period of fourteen months, repeated radiographic examinations have failed to show the existence of fragmentation There is an obvious fallacy in assuming that in this particular case, or in any other, fragmentation has never appeared for it is well known that advanced radiographic changes may exist long before the onset of any subjective clinical signs

It is to be remembered that the structural changes in the femoral epiphysis as opposed to the changes in contour, viewed radiographically are occurring inside a cartilaginous envelope which gives no definite indication itself of any participation in the lesion This applies also to those alterations in bony texture which are seen in the neck of the femur, and which we now proceed to describe

Changes in the Neck of the Femur —

1 *Contour* —The upper part of the femoral neck is seen to broaden, and its meta physeal end becomes as it were rounded off Coincident with this broadening there is a gradual shortening of the neck as a whole but this latter change is generally a less conspicuous feature until far on in the stage of healing (see *Figs* 363 366 373) The broad, squat neck is more strikingly illustrated in the late stages in childhood than in the final stage in adult life, but this difference is probably accounted for by the anatomical fact that the normal adult femoral head includes a contribution from the diaphysis At first sight the angle of inclination between the neck and shaft of the femur would appear to be lessened with the development of consequent coxa vara deformity This was originally emphasized by Calve, and in other earlier contributions in the literature was regarded as indicating true coxa vara But it is now generally conceded that there is no actual bending of the neck and that the depression is apparent and not real

2 *Internal Structure* —A variety of appearances may be seen in the sub epiphyseal region which do not permit of any hard-and-fast classification as regards type or chronology A common appearance is the development of an ill defined zone of alteration in calcification producing a spongy or pumice -like area in the upper part of the neck This represents apparently an early phase (*Figs* 357 359) A more regular pattern like arrangement of areas of condensation and rarefaction is occasionally seen and is associated with the stage of marked fragmentation and flattening of the head (see *Figs* 378 381) This type appears to be fairly constant in its form with the zones of condensation arranged as pockets opening towards the epiphyseal line, each one enclosing a corre-

ponding zone of rarefaction. Its existence has been commented upon and illustrated, particularly in the contributions of Delitala[18], Sorrel[21], Mouchet und Ill[2]. Like the fragmentation of the head it disappears in the evolution of the healing phase.

With changes occurring on each aspect the epiphyseal disc itself shows obvious variations in contour and extent which require no special description.

Changes in the Acetabulum.—It is somewhat surprising to find that the majority of writers on this subject tend to regard the acetabular changes as relatively inconspicuous, unimportant, or actually non-existent. Perthes states that the acetabulum shows no deformation except in very advanced cases. Sundt categorically declares that in the later stages the acetabulum is normal. Schwartz describes late changes which he classifies as hypertrophic, and secondary to the changes in the femoral head. It is probably true that it is difficult to give a clear word-picture of the acetabular participation in the cycle of osseous changes, but the existence of such variations is obvious. They can be seen at every stage, and they should be considered partly as the adaptation of the cavity to the altered lines of pressure through the deformed head and partly as of the same nature as the transformation undergone by the epiphyseal nucleus, and thus truly specific.

In *Fig* 371, a curious appearance will be seen in the acetabular roof on the left side: this in its contour recalls the regular pattern condensation zones of the femoral neck already referred to. Whilst the exact significance of this change is not apparent to my mind it depicts very clearly the early share of the acetabulum in the whole distinctive pathological process. Where the 'destructive' signs are unusually well marked in the femoral head the acetabular changes will be found to be equally striking (see *Fig* 367).

The final shape of the hip joint socket is in conformity with the final shape of the head. Where the discrepancy in size is great the acetabulum is shallow with a somewhat sloping roof (see *Fig* 383) but with a head of more normal dimensions though still deformed, the contour of the socket presents less alteration (see *Fig* 382). It will be noted that in these two examples there are no changes in the acetabulum which may be classed as hypertrophic.

Certain of the French observers (Merme[23], Mouchet and Ill[22], and Sorrel) have described an apparent widening of the space between the femoral head and its socket as typical of the active stage of pseudo-coxalgia. This appearance is explained by Merme as due to the increased transparency of the epiphysis, but by Sorrel as an indication that the upper end of the femur is displaced in a downward and outward direction. This widening of the articular clear space is an obvious sign in a good many of the illustrations reproduced in this paper but its special significance would appear to be obscure.

Chronology of the Changes in the Head, Neck, and Acetabulum.—The changes demonstrable in radiograms are probably seen in the femoral head before the neck presents any appreciable deviation from the normal, but all observations go to show that in the broad radiographic picture of pseudo-coxalgia, changes in the head and neck as a whole advance and recede coterminously. Thus, from radiographic evidence alone we are not justified in allocating the primary morbid bony change either to the head or neck. A consideration of this point will be of some importance later in the section devoted to the pathogenesis of pseudo coxalgia.

The Relation of the Radiographic Changes to the Clinical Manifestations.—It is at once obvious from a study of any considerable series of pseudo coxalgia cases that the abnormal radiographic changes must in many cases have been in existence for a considerable period before the onset of symptoms, unless we assume that the progress of the bony deformation may be one of extraordinary rapidity. We may illustrate this fact from a case in my own series—e g *Case* 13 (*Fig* 374)—where the greatest degree of fragmentation observed in the whole collection of radiograms is seen with a duration of symptoms of two months only. Other examples of an advanced phase with latent symptoms are seen in *Case* 12 and in *Case* 6 (*Fig* 364) where the history of subjective signs was definitely limited to a period of one month. In contradistinction to this may be quoted *Case* 1—undoubtedly exceptional—where comparatively early signs are still in existence at the end of one year after the onset of symptoms.

It thus seems to be the rule for the radiographic signs to become well established during a silent clinical stage, to progress still further during the time that symptoms are appreciable and objective signs are manifest, and to continue to advance long after the subsidence of these

The Possible Association of Specific Radiographic Appearances with Special Clinical Phenomena—Reference has already been made to the occurrence of complete fixation of the hip-joint by muscle spasm as one phase in the clinical life-history of most or all cases of pseudo coxalgia   There does not appear however, to be in the radiographic 'picture' one type or stage specially associated with the clinical stage of spasm   Thus, complete spasm may be seen with changes of a moderately early type as in *Case* 18, or with still more advanced phases as in *Cases* 3, 8, and 14   The same inconstancy is revealed where an adduction contracture of the hip joint is the outstanding sign

THE CLINICAL AND RADIOGRAPHIC END-RESULTS

Whatever may be the initial and intermediate changes which the femoral head may undergo, the presence or absence of deformation as an end-result is of primary importance It is evident from a scrutiny of the reported cases in the literature that the acquisition of a permanently deformed head is considered to be the rule in the vast majority of patients   Speculation has arisen as to the fate of these recovered hip-joints in adult life   I would suggest that this problem is illuminated by a consideration of the group of cases presented here (*Group II*) to which reference has already been made   It will be noted that in 4 a definite history of 'hip disease' during childhood was available, and in each case complete recovery was said to have taken place, with the retention of mobility in the joint   In one case (*Case* 21) the patient denies the previous existence of hip trouble in early life, and claims that his disability is of recent onset and is due to military service   The radiogram of this hip (*Fig* 384) in my opinion shows a typical end result of an old pseudo coxalgia, and even if the history of absence of hip symptoms in child hood is reliable, the presumptive evidence of this being an abortive type is strong   All these patients complained of symptoms at the time of examination e g   pain and stiffness, which had arisen after long years of complete freedom

On closer examination this group can be subdivided into two   (1) *Cases* 19 20, and 21, where to day there are symptoms of chronic joint strain but with no radiographic evidence of secondary arthritis , and (2) *Cases* 22 and 23, where radiographic signs of chronic arthritis are now manifest   I regard these two latter cases (which I have not examined personally), tentatively, but confidently, as examples of pseudo coxalgia with superadded chronic arthritis, the cause of which one cannot of course define   It may be suggested that here the original hip-joint condition in childhood was something other than pseudo-coxalgia and it is important to consider the possible alternatives which are two viz   a tuberculous arthritis or a subacute or chronic infective arthritis   Of these, the history and radiographic evidence at once rule out the former, but are not sufficiently definitive to exclude with certainty the latter, if such a type of hip joint lesion is admitted to exist in childhood

Schwartz has described one end-result of pseudo coxalgia is reproducing the picture of arthritis deformans   Froelich [24] from an experience of one case of undoubted bilateral pseudo coxalgia in a boy seen first at the age of five, and later at the age of nineteen with a clinical and radiographic diagnosis of essential coxa vara   considers that these two conditions are merely stages in the evolution of a single malady   It has been suggested by Taylor [2] Schwartz and others, that pseudo coxalgia may be one cause of arthritis deformans coxae in later life   My own view is that such end-results are to be considered as disabilities of the hip-joint superadded to the pre-existing deformed head of pseudo coxalgia   I regard as the normal end-result the one typified in the 3 cases presented in my own series but agree that in such hip joints the incidence of trauma, chronic strain, infection or other factors in adolescence early adult, or middle life, is likely to be unusually provocative of secondary changes

It is interesting here to compare these cases with the late radiographic changes in Cases 24, 25 and 26, representing the group of hip-joint affections designated as arthritis deformans juvenilis, to which we shall presently be led in our survey of the theories of the pathogenesis of pseudo coxalgia

ETIOLOGY AND PATHOGENESIS

ETIOLOGICAL FACTORS

Frequency—It is certain that amongst the hip-joint affections of childhood, pseudo-coxalgia is by no means rare   As already stated, Calves first series of 10 cases were identified in about 500 children suffering from chronic affections of bones and joints and designated as tuberculous   Delitala[18] found 4 cases in 1000 miscellaneous hip-joint conditions, and typical radiograms in 2 out of 1000 hips examined   Sorrel had 6 cases in 1500 children with chronic osseous and joint lesions (mainly tuberculous) , whilst Sundt whose writings have been repeatedly quoted in this paper, out of a series of 243 hip-joint lesions admitted to a special maritime hospital, discovered 41 examples of pseudo-coxalgia   The latter authority indeed states that tuberculous arthritis of the hip-joint is a much rarer disease than is generally held   In hip joint diseases studied under conditions similar to those of Sundt, Gauvain[26] was able to recognize 12 cases of pseudo-coxalgia out of 251 cases of alleged tuberculous coxitis

Sex—It has been claimed that the condition is found predominantly in boys except where a number of cases are included in any series in which the changes characteristic of this affection have supervened upon the reduction of a congenital dislocation of the hip   In 50 cases collected from various sources by Delitala in 1915, the proportion of boys to girls was 4 to 1   This predominance of the male sex has been quoted as contributory evidence in support of the traumatic theory of the causation of pseudo-coxalgia

It will be noted that in my own series of 23 cases (including the adults of *Group II*), 12 were males and 11 females   In this series no cases of congenital dislocation of the hip are included   I am not however prepared to suggest that this unusually high incidence in girls is other than purely fortuitous in a comparatively small group of patients

Hereditary and Familial Factors—Schwartz quotes two cases occurring in brothers, Calve in brother and sister, and Brandes three in the same family   Levy[27] has seen the condition reproduced in three generations and Eden[28] in father and son   There is absolutely no evidence to prove that any special significance is to be attributed to these observations although it has been suggested by Brandes that in pseudo-coxalgia there is some congenital predisposition towards the development of bony softening

Age—The disease shows a clear predilection for the second half of the first decade of life   but the lowest age recorded is $2\frac{1}{4}$ years (Legg)   Mouchet and Ill consider that the lesion never develops after the age of 13   but on the other hand Schwartz has reported one case in a girl of 15 following the reduction of a dislocated hip   In my own series it will be seen that the average age at which symptoms became manifest was 7 years , and there is no case in which the onset of symptoms or objective clinical signs occurs below the age of 5 or above the age of 12   The age incidence is to my mind a distinctive feature, and is in contrast to that of tuberculous disease of the hip, which in the vast majority of cases begins before the age of 5 and usually about the third year

Bilateral Affections—Bilateral affection of the hip-joint is quite rare   In Legg's 55 cases there were 2   in Perthes' 28 cases a similar number , and, in the exceptional series of Sundt 7 out of 75   My own series includes 2 examples of bilateral pseudo-coxalgia   so that the proportion of bilateral cases from these combined figures would appear to be about 7 per cent

There are other factors such as trauma, the presence or absence of the signs of rickets, and the data afforded by the results of the specific tests for tuberculosis and syphilis, which are of considerable importance in relation to the theories of pathogenesis, and which will receive attention in the next section

THEORIES OF PATHOGENESIS

In contrast with the clearly defined clinical and radiographic picture of this disease which has been arrived at by a good number of observers, is the nebulous indeterminate atmosphere which surrounds the various theories now in existence regarding its causation and nature   It must be admitted at once that inherent difficulties are encountered in marshalling evidence which is more than of mere contributory value, in support of any particular view   There has been a natural tendency, once the condition was recognized to allocate it forthwith to a position of isolation in the group of hip joint affections   Its radiographic features, so distinctive and cameo like in their manifestations amongst the common and uncommon pathological variations of the hip-joint, have in themselves alone constituted tempting foundations for speculative hypotheses   But it is to be remembered that in the interpretation of radiograms we are visualizing concretely changes in bone as a substance and not as a tissue, and that, for this reason, in a pathological sense we must realize that our vision has definite limitations

The many differing conceptions which have been brought forward, especially during the last year, on close analysis provide us with two distinct schools of opinion   In the first of these, pseudo coxalgia is considered to be a pathological entity with a single underlying specific cause   In the second, the condition is rather to be classed as a morbid anatomical change which may be the resultant of the influence of a variety of causes acting singly or in combination   We may examine in turn the group of pathological factors which have been stressed by the chief contributors to this subject

Trauma—There is a consensus of opinion as to the frequent appearance of a history of preceding injury in the syndrome of pseudo coxalgia   In the view of Legg, trauma is the sole determining etiological factor   His reasons for this are threefold   the history the preponderance in the male sex (boys being supposedly more liable to accidents) , and —in his own series of cases—the not infrequent development of the changes of pseudo coxalgia after the reduction of congenital dislocations of the hip, and particularly in cases where difficulty in reduction had been experienced   Legg depicts the train of events somewhat as follows   As the result of an injury there is an obliteration of a portion of the vascular supply of the femoral epiphysis, which in consequence undergoes the atrophy of anæmia   A compensatory hyperæmia of the femoral neck is the natural response, and is the starting-point of those hypertrophic changes which are denoted by the occurrence of broadening   Schwartz accepted a somewhat similar explanation, and postulated, as the result of vascular injury, a looseness of the attachment of the head to the neck Perthes, whilst recognizing that a history of trauma is inconstant and is a somewhat slender foundation on which to erect a comprehensive view of the pathogenesis, in emphasizing the parallel afforded by this disease and the condition long known as osteo chondritis dissecans, is reluctant to relinquish the traumatic theory   These are amongst the earlier views   More recently, Sundt, who recognizes a group of causative factors, puts trauma first—e g , in his own cases, the determining factor in 53 3 per cent   An interesting example of the apparent close relationship between trauma and the onset of this disease is reported by Elmslie,[29] where a typical pseudo coxalgia developed in a hip joint which a year before had been subjected to the violence of a traumatic dislocation

In my own series information regarding the potency of this factor is scanty , in not more than one-third of the cases can a history of injury be elicited, and in but two was it in any way reported spontaneously by the parents of the child   The incidence of trauma would appear to be just as frequent in other affections of the hip joint—most notably in tuberculous arthritis   To my mind the importance of this factor should not be over emphasized on evidence derived from clinical histories alone   Legg s hypothesis rests essentially on the collateral evidence provided by his special sub group of cases associated with congenital hip dislocations   and in no other work has this type of pseudo coxalgia been recorded in such large numbers   Brandes on the contrary   had one case in his collection where pseudo coxalgia developed in the non luxated hip only   It is well recog nized that in many cases the femoral epiphysis of a reduced congenital hip dislocation

presents bizarre changes when studied after a period of some years Such hip-joints differ widely from the anatomical normal Many of the changes are indicative of a form of arthritis conveniently termed absorptive arthritis (Fairbank[30]) or dry arthritis (Bargellini[31]), and in this, flattening of the femoral head is often a striking sign An example is seen in *Case 35 (Group IV)* of my own series If these femoral deformities which arise in connection with congenital hip dislocations are to be considered as pseudo-coxalgia proper, evidence must be adduced to prove the occurrence of all the pre-existing phases which lead up to the stage of flattening, e g , fragmentation A number of undoubted cases which fulfil these requirements are illustrated in Legg's most important contributions Three such cases are also recorded by Fairbank,[30] and brief reference is made to similar cases in a number of other contributions The relative frequency, amongst the deformation changes following the reduction of a congenital hip dislocation, of those peculiar to true pseudo-coxalgia, compared with the ill defined changes of absorptive arthritis, is a matter on which further investigations are required From a comparatively small number of personal observations my conclusions are in favour of regarding the latter type as common, and the former as rare

Bilateral involvement of the hip joint in pseudo-coxalgia, as pointed out by Perthes is difficult to explain on the assumption of a universal traumatic theory An attempt to support this theory from the experimental side has been made independently by Legg and by Allison,[12] both of whom have failed to reproduce the lesion in animals after the infliction of injuries to the head of the femur

To sum up, I consider that there is little more than a mere clinical association between the development of pseudo coxalgia and the previous infliction of a definite injury to the hip joint The evidence in favour of establishing a causal relationship between the two is of suggestive value only, and in my opinion the traumatic theory must still be regarded as based on a slender foundation This view is held by a number of other writers (Brandes Fiocheh, Merine Mouchet, and the French school in general)

Rickets —Calve, who was originally responsible for the view that pseudo-coxalgia was a rachitic manifestation, has now rejected this theory , but the conception has persisted and has passed over to certain German observers, notably Fromme [33] The latter has endeavoured to correlate a wide variety of osseous lesions in one generic class labelled late rickets In this, pseudo coxalgia is linked closely with such conditions as apophysitis of the tibial tubercle (Osgood Schlatter disease) and tarsal scaphoiditis (Kohler's disease)

Signs of rickets are not uncommonly associated with pseudo coxalgia Thus, in 94 cases collected by Sundt (including his own considerable series), there was a history of rickets in 32 Careful examination on this point has been made on all the patients in my series, who are largely hospital cases drawn from a densely populated area in a city in which rickets is considered almost a normal phase of childhood In 3 out of 18 there were well-marked rachitic stigmata , in the remaining cases where in the records slight signs of rickets are noted, these were of a degree commonly seen in children of all types in the out patient departments Sundt is inclined to accept rickets as also a possible causative factor and in 7 bilateral cases assumes that the disease was founded on a rachitic basis

The position of rickets to my mind is exactly that of trauma—purely a chance association The strongest evidence against the rachitic theory is the radiographic cycle of bony changes which are totally unlike the changes seen in any part of the skeletal system at any stage in children or adolescents suffering from rickets Apart from the common coxa-vara deformity of the rachitic child, the hip-joint shows strikingly few changes, and is an unreliable index of the activity and degree of the rachitic process when compared with the knee joint or wrist joint The clinical material in my services is particularly rich in the most advanced types of rickets seen in childhood and in adolescence, and a scrutiny of the large collection of radiograms available has been carried out with particular reference to this point We have found that any variation in type in the upper epiphysis of the femur is rather in the direction of the assumption of a more globular form, with an accompanying cupping of the diaphysis Even this change, in my experience, is com-

Congenital Abnormalities of Ossification—By a process of exclusion, Delitala was driven to the conclusion that the changes in the head of the femur were developmental and indicative of an abnormal delay in the formation of the nucleus of the epiphysis A similar view has been adopted by Weil [34] But there seems to be little if any evidence in favour of this theory   Against it are two facts, viz , the common appearance of pseudo coxalgia in a hip previously known to present a normal femoral head, and the consistent age of onset at a time when under normal circumstances the ossification of the epiphysis is well matured

Syphilis—It is agreed by all that the clinical signs of congenital syphilis are invariably lacking, and that the specific serum test is rarely if ever positive in pure uncomplicated pseudo coxalgia   (See cases in *Group I* and *Group II*)   There are the strongest grounds for at once excluding syphilis absolutely from the group of potential etiological factors, and the claims of Roberts,[35] of New York, for the recognition of this disease as a syphilitic osteochondritis, must be regarded as based on unsound evidence

Infection—The possible rôle of infection will be discussed in greater detail when we come to deal with the nature of the morbid changes in this disease   From clinical evidence alone we see the occasional association of an infective process with pseudo coxalgia, evinced either by the history of some definite preceding acute infective illness or by the occurrence of coincident signs such as pyrexia and vague ill health   As examples of this relationship may be quoted the cases of Perthes, Brandes, Taylor and Frieder, and Sundt, all of which followed a mild acute polyarthritis, and the two cases in my series which passed through a stage of pyrexia for which no other cause could be found

In *Group IV* in my series is included a single case (*Case* 24) of flattening of the head of the femur in a hip-joint which was the former seat of an acute post scarlatinal arthritis one of three such cases with this type of deformity which have come under my observation   The early radiographic records of this patient are not in my possession, and as flattening of the head represents a late result, the case is classed as a coxa plana secondary to a known specific cause   In my opinion this is the true category for this particular case and for others of the same type   They should not be regarded as examples of true pseudo coxalgia   Here again, as in the flattened femoral head of the reduced congenital hip dislocation, we are dealing with an epiphyseal deformation which, seen in the late stages only resembles to a certain degree that of the healed stage of pseudo-coxalgia proper

Variations in the Activity of the Endocrinal Glands—In 1909, according to Perthes Lawen showed the typical radiographic appearances of pseudo-coxalgia in a cretin of eleven years , but this is an isolated observation   Certain observers have not, however, been prevented from traversing those realms of pure conjecture afforded by the interplay of the endocrinal glands   Brandes and Sundt have both relegated this disease to a group of bone dystrophies in which a disturbance in balance of the endocrinal bodily mechanism is the presumed underlying fundamental cause   This is 'theory' in the pure sense of the term

MORBID ANATOMY AND LIVING PATHOLOGY

We have already indicated that most observers have been dependent on the assemblance of clinical and radiographic data for information regarding the probable nature of pseudo coxalgia   and we have further stressed the fallacies involved in the correlation of distinctive radiographic signs with any single pathological lesion of bone   With a clear understanding of these limitations, we can still proceed far along the path which leads to the attainment of a logical conception of the nature of the disease under consideration Before proceeding to this question it is necessary to review certain observations which are now available on the morbid anatomy and the living pathology of pseudo coxalgia

Kreuter[36] has recently had an opportunity of examining a hip joint during an autopsy in a boy of seven years who was known to have a bilateral pseudo coxalgia   The finer changes in the femoral head described by this author did not appear to fit any one picture, but from them he has adduced the primary lesion, which he states to be a loss of elasticity in the articular cartilage of the femoral epiphysis

Four surgeons have succumbed to the temptation to explore the upper end of the femur at operation. Legg himself opened into the femoral neck in one of his original cases, discovered a large area of rarefaction which was demonstrable in the skiagrams, and obtained from the material evacuated a growth of staphylococcus. In 1913 Perthes removed at operation a small piece of the femoral head with a few tags of synovial membrane. On histological examination the latter proved to be normal, but the interior of the epiphysis exhibited a change which, in brief, consisted of the replacement of cancellous bone by invading buds of cartilage. Perthes considered that this process was non-inflammatory in type, and he defined the lesion as being essentially subchondral in its location. The terminology he then introduced as the result of his findings—viz., osteochondritis deformans—has remained attached to this disease ever since, and is one of the most popular of its titles.

Kidner,[27] impressed by the cavitation appearances in the neck of the femur, which he looked upon as indicating the presence of a mild form of osteomyelitis, tunnelled into the interior of the neck in a boy, age 5, with a typical pseudo-coxalgia. From the cavity was curetted debris, which on cultivation showed the presence of a *Staphylococcus aureus*. The process of healing in this cavity was followed in subsequent radiograms, and it was claimed that the operation hastened this, and indirectly diminished the ultimate degree of deformation of the femoral epiphysis.

An elaborate histological description of the changes in the femoral head has recently been provided by Phemister[38] from a study of a portion of the epiphysis removed after curettage of its interior. The contents gave no microbic growth, but the changes demonstrated in the tissue removed were said to be typical of an old infective lesion of bone, and probably of pyogenic origin. At operation the joint cavity gave evidence of the presence of an active synovitis, but the articular surface of the deformed head retained its normal sheen. These findings and their interpretation must be considered as significant, coming as they do from a recognized authority on the pathological histology of bone.

THE SIGNIFICANCE OF THE CLINICAL AND RADIOGRAPHIC SIGNS

There is obvious room for wide variations in the conclusions which may be drawn by any particular observer from a study of the clinical and radiographic manifestations. It is convenient at this juncture to bring forward a conception which one regards as reasonably logical, and which has been already foreshadowed in the analysis and resulting criticisms introduced into our survey of the field of etiology and pathogenesis.

In my own view there is strong evidence upon which we can base a conception of this disease as essentially inflammatory, and exhibiting clinical phases and types of varying intensity. The morbid process on the whole would seem to belong to the type of inflammatory bone lesion in which the infective agent is of attenuated dosage or potency. The whole clinical and radiographic picture is in accordance with this point of view. Thus, we may stress the clinical signs of irritability of the hip-joint, so marked in those cases where there is a continuance of total muscle spasm for lengthy periods, and the occasional presence of pyrexia or the general signs of ill health. Again, we see the participation of all the elements of the joint in a cycle of changes appreciable to our radiographic vision and localized to the osseous tissue of the cartilage clothed femoral epiphysis, metaphysis and acetabulum. The definite early changes seen in the last situation have already been emphasized, and to my mind they constitute a sign of the greatest value in relation to the evolution of our present thesis. In further support of this we may add the important histological investigations of Phemister described above. The clinical association of pseudo-coxalgia with pre-existing infective conditions has already been considered, but one does not quote this as necessarily sound contributory evidence, for I believe that there exist hip-joint deformations of infective origin in which flattening of the head of the femur is the outstanding change, and which should not be included in the category of pseudo-coxalgia (see *Group IV*).

It is a matter of universal agreement that in the morbid changes the cartilaginous lining of the hip joint retains its gross integrity, and, as far as is known, its histological structure unchanged   If, then, we are to apply a pathological label to the disease at this stage in the argument, that of 'osteochondritis deformans' introduced by Perthes is to be considered worthy of adoption

Whilst from radiographic investigations the earliest changes are seen to be located in the epiphysis, we are not justified in assuming that here is the starting-point of the morbid process   Diehmann (quoted by Brandes), also on radiographic evidence considers that the primary change is seen in the neck on the under surface of the epiphyseal disc, and he is not alone in this opinion   In the early paper of Waldenstroem, where a series of undoubted cases of pseudo coxalgia were reported as a special form of primary tuberculous osteomyelitis of the femoral neck, the localization of the supposed neck lesions was discussed in relation to the vascular supply of the upper end of the femur   He tried to show that the area of the neck involved represented the territory supplied by the upper leash of metaphyseal vessels (Lexer)   The changes in the head were thus considered to be secondary, and this view is still held by this author although he has rejected the idea that the lesion is a manifestation of a mild tuberculous infection

There is really no evidence available which will enable us to deal finally with this question of priority, and it matters little whether we regard the initial site of the lesion either as epiphyseal or diaphyseal   The influence of Lexer's work on the vascular supply of the epiphyseal region—investigations almost entirely limited to the anatomical conditions in early infancy—has led to a too hard and fast reliance on the scheme typified by the apparent complete lack of intercommunication between each individual leash of blood vessels   It is more logical in this connection to look upon the vascular supply of the components of the hip joint in a child as a single unit   During the age period favoured by pseudo coxalgia the supply of the metaphyseal region affords a greater opportunity for the settling of blood borne infections than the less well vascularized synovial membrane, thus we see the dominance of the subchondral changes   With the approach of adolescence the discrepancy between the two supplies is less marked, and the joint proper is more likely to show early involvement, that is, the lesion is likely to be a true arthritis

We shall not leave this inquiry into the role of the vascular supply of the upper end of the femur without emphasizing what should be realized more widely, viz   that the function of the ligamentum teres is not that of a vascular carrier, and that the few vessels it contains in early childhood supply merely a small area of superficial cartilage corresponding to its femoral attachment (Walmsley[3J])   The obliteration of an imaginary supply in this structure following injuries of the hip joint has been quoted in support of the traumatic theory of pathogenesis

Whether we accept the view that the changes of pseudo coxalgia represent a mild inflammatory disease of bone—an osteochondritis—or not, it is natural to inquire if similar radiographic appearances can be found in other anatomical situations, and if so under what conditions   Attention has been drawn to the close resemblance of certain transformation changes of the femoral head to those which are seen in the tarsal scaphoid in the condition known as Kohler's disease   Both lesions have certain clinical features in common inasmuch as the subjective phenomena are often silent, are relatively transient and are preceded and outlasted by the objective osseous changes   In the stage where the scaphoid contour is reduced to a thin disc with its bony texture showing as a dense plaque one of the phases of the femoral epiphysis in pseudo-coxalgia is recalled   There is one important difference however for the scaphoid is believed to return always to the normal   Then again   the average age incidence in this latter disease is lower   it is probably never seen after the sixth year

The condition known as apophysitis of the tibial tubercle (Osgood Schlatter disease) has also been cited as constituting a parallel bone change   There does not appear to be any constant radiographic picture in apophysitis of the tibial tubercle, as far as one can ascertain from a limited number of personal observations   The clinical predilection of

this lesion is also for a period later than that of pseudo coxalgia, but in its general course, on the whole, the parallelism is sufficiently striking

The French school following the lead of Froelich,[30] have boldly grouped these three conditions under the term 'osteochondrite de croissance' A single observation is on record of the coincidence of pseudo coxalgia and tarsal scaphoiditis in the same patient (Hertz[31]), and it has been suggested by Sorrel that a systematic radiographic investigation of the tarsus should be made in all cases of pseudo-coxalgia But, as pointed out, these affections, whether related or not, tend to appear at different periods of life, so that their coexistence is likely to be infrequent

This view has received a considerable measure of support, and its author believes that all three conditions are due to an infection by pyogenic organisms of attenuated virulence We may state here that from personal observations the association of trauma with scaphoiditis and tibial apophysitis appears to be entirely fortuitous

FLATTENING OF THE HEAD OF THE FEMUR IN OTHER CONDITIONS

We may now return to a final review of the cases in *Group IV* of my series, to which attention has been directed from time to time This represents a selection from a larger series of morbid hip joints which show a deformation of the head of the femur, at first sight resembling the healed stage of pseudo coxalgia I have included these under the title of 'coxa plana' a term introduced originally by Waldenstroem, and now adopted by Calve[4] The flattening of the femoral head in this miscellaneous group is to be regarded as a secondary change and relatively unimportant when compared with the primary lesion affecting other joint elements With the exception of *Case 35*, a bilateral congenital dislocation of the hip-joints, the only radiographic records in my possession are those in which the flattened head has already attained the stage depicted in the illustrations This deficiency is of course of little moment in *Cases 31* and *32*, which are examples of the flattening which is occasionally seen in tuberculous arthritis of the hip-joint, but it tends to render less convincing, perhaps, the distinction which exists between such examples is *Cases 29* and *33* and pseudo coxalgia proper

In the first of these, *Case 29 (Fig 393)*, tuberculous osteomyelitis of the femoral neck the flattened head is of a degree and type seen in some cases of pseudo-coxalgia, in the neck however there is a striking change which is quite distinctive, a focus of chronic osteomyelitis which had given clinical evidence of its presence by the formation of an extra-articular abscess The appearance here should be contrasted with the pattern-like foci seen in the cases of pseudo coxalgia illustrated in *Figs 378* and *381*

In the post scarlatinal arthritis which shows a flattened head (*Case 33*), the radiographic appearances are totally unlike the later stage of true pseudo-coxalgia, so that the distinction here is evident at once

It is I think certain that flattening of the head of the femur may occur in a number of hip joint affections which are in no way related to pseudo coxalgia, either as a temporary phase preceding total destruction, or as an end-result Such flattening is of a secondary nature and its evolution is probably dependent on a combination of factors in the earlier stages in time and in the later stages static influences The clinical and radiographic features as a whole in most of these cases differ markedly from those of pseudo coxalgia, but confusion may arise where flattening of the femoral head is seen to accompany an osteomyelitic process in the femoral neck I believe that cases of the type of *Cases 29* and *31* have occasionally been included in the class of pseudo-coxalgia, but without due reason Three years ago[13] I emphasized the distinction between these cases of secondary flattening and pseudo coxalgia proper and further investigations have strengthened my belief in this conception This group has been referred to in this paper for convenience under the heading of coxa plana but this term is utilized in a sense contrary to that of Waldenstroem and Calve who would also include pseudo-coxalgia which in their view may be the ultimate expression of several widely differing etiological factors, e g, trauma infection constitutional or congenital causes Waldenstroem classifies hip-joint

deformations into three—coxa vara, coxa valga, and coxa plana—thereby emphasizing the opinion that pseudo-coxalgia is not a true entity This little group of cases in my series has been introduced in juxtaposition to the cases of undoubted pseudo-coxalgia in order to strengthen the conception which one considers to be absolutely logical—viz , that pseudo coxalgia is a definite pathological entity with a single etiological basis It is a striking fact that the radiographic picture of pseudo coxalgia is mimicked best of all by those conditions in which there is no doubt as to the existence of an inflammatory lesion—i e , osteomyelitis—of the femoral neck

THE RELATION OF PSEUDO COXALGIA TO ARTHRITIS DEFORMANS JUVENILIS COXÆ

We see reappearing from time to time in the literature on this disease references to its relationship to that affection of the hip joint known as arthritis deformans juvenilis A scrutiny of this literature shows that there is a definite confusion as to the exact nature of arthritis deformans juvenilis, or even doubts as to its probable existence We have seen how the first recognition of pseudo-coxalgia by the Teutonic surgeons was, in essence the isolation of a special form of arthritis deformans juvenilis, and then the withdrawal of pseudo-coxalgia from this category

The two diseases may be considered together for the purposes of contrast and correlation In the first place it must be obvious to anyone who has made a comprehensive investigation of a large series of hip-joint affections, that whilst pseudo coxalgia is not uncommon, a hip-joint lesion corresponding to the arthritis deformans juvenilis of the German writers is so rare as to be virtually non existent during the age period at which the former appears This fact simplifies our perspective view of pseudo coxalgia, for it is quite certain that every case reported in the literature as an arthritis deformans juvenilis in a child was an example of the former disease An interesting illustration of this may be seen in the article of Pieiser[44] in 1907 on arthritis deformans juvenilis where a skiagram is reproduced which shows the typical fragmentation stage in the head of the femur

The question now arises is to the period of life to which arthritis deformans juvenilis if it exists, may be allocated This point may be settled by a reference to the hip joint affections in my series included in *Group III* It will be seen that this chronic joint lesion is definitely an affection of the adolescent period, that considerable distortion of the head occurs as an end-result, in common with other signs of true arthritis, and that the tendency is for the changes in the hip-joint to progress slowly but surely in the direction of the production of ultimate ankylosis We do not need to do more than contrast this picture with that of pseudo coxalgia, either in its varied phases in childhood or in adult life

The youngest patient in this little group (*Case* 24) showed the onset of symptoms it the age of fourteen, and it was considered for some time that here was an example of bilateral pseudo coxalgia arising at an unusually late age I have now definitely assigned this case to the arthritis deformans juvenilis class, but I consider it represents a bridge, is it were between the pseudo coxalgias and arthritis deformans juvenilis, and in my opinion it illuminates the pathological inter-relationship between these two affections This I consider to be as follows The type of infection which produces the lesions characteristic of pseudo coxalgia at a certain period of childhood will at a later stage, produce a lesion of the hip joint which on radiographic and clinical evidence belongs to the class of true arthritis—chronologically another definite entity The reason for this difference in reaction of the joint structures to infection is an anatomical one, and it is suggested that it is dependent on those changes in the vascular supply of the hip-joint which appear with approaching adolescence and which have already been considered

THE RELATION OF PSEUDO COXALGIA TO TUBERCULOSIS OF THE HIP-JOINT

In the introduction to this paper we assumed that from the first recognition of pseudo coxalgia, it was universally conceded to be a non tuberculous affection No

subsequent investigations have shaken this conception, and it is unnecessary to do more than merely record this continued unanimity. We may refer in passing to the consistently negative results of the tuberculin skin reaction (the diagnostic limitations of which are fully appreciated) in *Group I* of our series, as compared with the positive reactions seen in the five tuberculous hip lesions in *Group IV*.

CONCLUSIONS IN REGARD TO ETIOLOGY AND PATHOGENESIS

1. Pseudo-coxalgia, or osteochondritis deformans juvenilis coxae, is an inflammatory lesion of the upper end of the femur, the changes being subchondral in location.

2. The condition is most probably due to a definite infection of low-grade virulence. It is impossible to postulate the exact site of the primary implantation of the infection, which reaches the femur by the blood-stream; in the well-marked active phase all the joint elements participate in the cycle of osseous changes.

3. The disease is to be regarded as a definite pathological entity amongst the hip-joint affections of childhood.

4. Pseudo-coxalgia shows a definite predilection for the second half of the first decade of life.

5. In the period of adolescence the reaction of the hip-joint to the type and grade of infection which produces pseudo-coxalgia at an earlier age, is manifested by the production of an arthritis deformans. Arthritis deformans juvenilis is never seen during the age period appropriate to pseudo-coxalgia.

TREATMENT

The tendency towards the occurrence of spontaneous recovery in pseudo-coxalgia is common knowledge. We have seen how the duration of those subjective signs which indicate the existence of joint irritability may vary considerably, how the ultimate shape of the femoral head may occasionally be little changed from the normal or may be conspicuously deformed, and how the resulting abnormal hip joint may in adult life, in response to the incidence of strain or infection, become a source of disability to its possessor. It is thus pertinent to consider the possibility of so influencing the conditions of the hip-joint as to produce an arrest of the steady march of the bony changes in order to ensure as full restoration of the femoral head as may be possible.

This problem resolves itself into a consideration of the effects of the conservative measures of immobilization and protection of the hip-joint, and, at the other extreme, the applicability of operative treatment directed towards the eradication of localizable inflammatory foci in the epiphysis or diaphysis.

IMMOBILIZATION AND PROTECTION OF THE HIP-JOINT

There has been no definite lead as to the value or otherwise of these therapeutic measures in the literature on this subject until the appearance of the recent monograph of Sundt. Such data have been difficult to obtain in patients who as a routine achieve recovery with no apparent disability. In my own investigations I have endeavoured to ascertain the influence of immobilization of the hip with protection from weight-bearing as depicted in successive radiograms. In a number of patients, particularly those seen at the first examination with complete fixation of the hip by spasm, or where in adduction contracture existed, immobilization has been carried out over varying periods. Also in a few patients the hip-joint affection had been treated as a tuberculous one by the conventional methods before they came under my observation.

My conclusions may be summarized as follows:—

1. That where the onset of symptoms coincides with the existence of very early radiographic changes—e.g., simple flattening before the stage of fragmentation—immobilization, instituted at once and maintained for a year or longer, may help to retard, but will not avert the cycle of bony changes. It is still possible, however, that in these

circumstances the final deformation of the femoral head may be of a less degree than in the average untreated case   Such opportunities are rare

2   There is no evidence to show that these measures in any way influence the train of bony changes when these are well advanced at the time of the onset of symptoms Progressive dissolution signs can be followed in such cases in the femoral epiphysis during the period of immobilization (see *Fig* 369)   The bilateral *Case* 9 in my series at first sight appeared to offer a striking proof of the influence of body-weight on the contour of the epiphysis during the active stage   Here, the hip which had given rise to symptoms was immobilized for two years, and at the end of this time the femoral head showed a less advanced degree of flattening than was exhibited by the 'silent' hip on which body-weight has been carried continuously   But we have no evidence that the primary bone changes began simultaneously in the two hips, and in the final radiograms there is less difference in the two sides than before (see *Figs* 365 and 366)

Sundt has been able to watch the effects of treatment or lack of treatment over a prolonged period in three groups of cases, as follows   (1) Nineteen cases in which the hips were immobilized for two years , (2) Sixteen cases where the hips were immobilized for one year , and (3) Twenty-three cases which were allowed complete freedom   His opinion is quite definite that no difference in the degree of deformation was found in the three groups   At the same time, in spite of such negative findings, I consider that it is a sound practice to immobilize these hip-joints for a reasonable period in cases where spasm is marked, or where there is a considerable limitation of the range of abduction   For the latter contracture it is further advisable to overcome this limitation by gentle stretching under an anæsthetic, a procedure recommended amongst others by Muirhead Little,[45] Schwartz, and Brandes   There are no definite reasons for the adoption of a prolonged period of immobilization , but it is reasonable, in view of the average pace of the bony changes, to make this at least six months

OPERATIVE EXPLORATION OF THE HIP JOINT

Kidner has advocated early exploration of the interior of the femoral neck as a logical method of removing what he regards as the primary focus of the disease   In the one case he has reported, it is claimed that the ultimate deformity of the head was thereby lessened   On the other hand, Phemister s single operation was an arthrotomy and involved as a curative measure the curettage of the interior of the femoral epiphysis Judged from a therapeutic standpoint, it must be stated that in neither of these operations was the period of subsequent observations of sufficient length to be convincing   Whilst the information resulting from the exploratory operation of Phemister has been of considerable interest and value in the study of the pathogenesis and morbid anatomy of this disease, there appears to be no sound surgical reason for its further advocacy   As a precedent such an operation is dangerous, for there may arise a host of imitators less competent to restrict its range of action than its introducer

SUMMARY

1   Pseudo-coxalgia or osteochondritis deformans juvenilis coxæ is a definite entity representing the reaction of the metaphyseal region of the upper end of the femur to the stimulus of an infective agent of attenuated virulence

2   The condition is comparable with the arthritis deformans juvenilis coxæ which is seen solely in adolescents, and which represents at this age period the reaction of the hip joint to an infective agent of a similar type

3   The whole cycle of radiographic changes is peculiar to pseudo coxalgia alone They precede and outlast the clinical phenomena   The final picture is dominated by the deformation of the head of the femur, which is enlarged and flattened   The acetabulum in its final form can no longer contain the whole of the expanded head

4   Deformation of the head of the femur with flattening and expansion is seen also in conditions distinct from pseudo coxalgia during childhood   There is no evidence to

show that in these conditions the typical structural osseous changes of pseudo-coxalgia have preceded the stage of flattening   At certain stages the clinical and radiographic pictures of the two groups of affections may show considerable resemblance   This applies particularly to cases of primary tuberculous osteomyelitis of the femoral neck

5 In the conditions known as tarsal scaphoiditis (Kohler s disease) and apophysitis of the tibial tubercle (Osgood-Schlatter disease), bony changes parallel to those in pseudo-coxalgia are found

6 Conservative treatment directed towards the elimination of weight-bearing has no proved influence on the train of morbid changes, but its application is indicated during the stage of prominent symptoms   Operative treatment directed towards the removal of the dominant lesion has no present place in the therapeutics of this disease

During the whole course of my observations I have had the valuable co operation of my radiological colleagues, Dr J M W Morison and Dr A E Barclay, to whose unstinted help I here pay tribute

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NON-UNION OF FRACTURES

By H J WARING and E T C MILLIGAN, London

This paper on non-union of fractures deals with two classes of cases typical of the end-results of bone injuries which have resisted treatment to bring about union —

I   *Cases in which Apposition Obtains* —In these the fractured bones are in alinement, and x-ray photographs show the fractured ends together   In some, apposition was never disturbed by the original injury, the fracture line being transverse or slightly oblique   In others, apposition had been brought about by previous operative treatment at the hands of other surgeons in an attempt to induce union—wiring and plating having been practised   The fractured ends remain in contact, but union has failed (*Fig* 421)
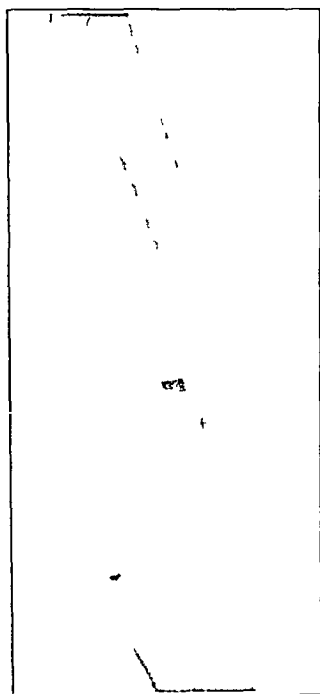
FIG 421 —Show non united fracture of humerus with gap between fractured ends

FIG 402 —*Case 9*   Shows non union of humerus with false joint and angulation forward   The line of fracture of the lower fragment is transverse In the upper fragment it is slightly oblique due to the small third fragment uniting to the upper fragment

II   *Cases where there is Want of Apposition from Longitudinal Displacement* —In these the fractured ends are separated by a gap of varying length due to loss of bone, with

(Fig 419) or without *(Fig 401)* a rigid parallel bone preventing the fractured ends from coming into apposition, as for instance in the leg, where an unfractured fibula prevents the fractured ends of the tibia from approximating

Class I **Cases where Apposition Obtains** —It may be stated that in certain areas in some long bones there is at times a definite tendency to failure of repair after certain types of fractures, even though apposition obtains and all sound principles of treatment have been carefully carried out   These areas are   (1) The middle two-fourths of the shaft of the humerus *(Figs 402, 413, 421)* , (2) The lower third of the shaft of the tibia , (3) The neck of the femur , (4) The upper third of the shaft of the femur *(Fig 103)* , (5) The middle third of the shaft of the femur *(Fig 404)*   In (4) and (5) severe prolonged infection usually precedes the occur-rence of non union
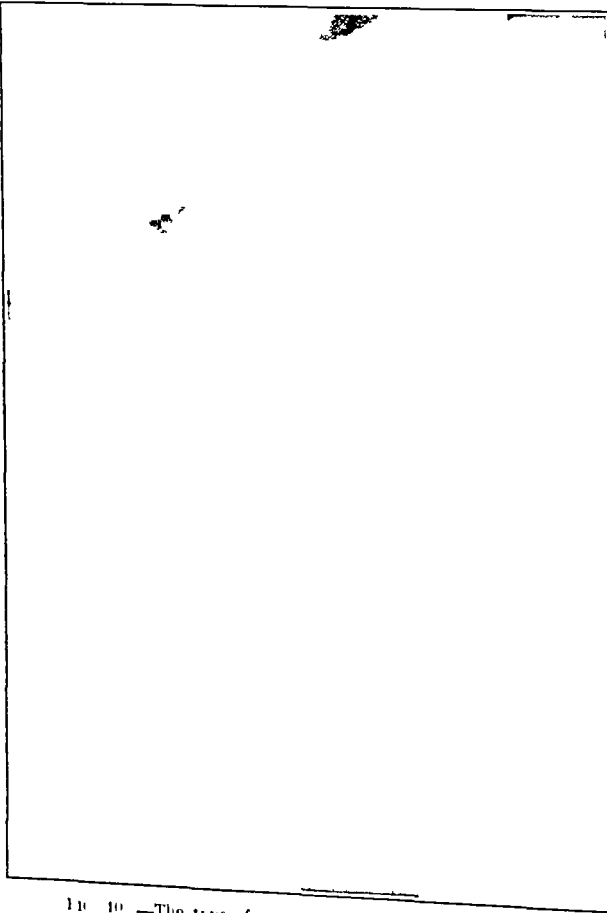
Fig 40 —The type of non union of upper third of femur

In uninfected and simple fractures where non-union has resulted, the line of fracture is almost always transverse or slightly oblique , non-union never occurring in greatly comminuted or impacted fractures   The fractured ends apparently normal in structure, are in apposition and connected together closely   Alinement is good but there is loss of power and rigidity of the limb, which is almost useless

Fig 404 —Showing gunshot wound of middle of shaft of femur   There is a gap between the ends which is imperfectly filled with an open irregular callus   Non union had resulted although bone grafting and plating had been practised by others   A discharging sinus has up to the present prevented it from performing the operation of comminution and impaction

with fibrous tissue, often very

In infected fractures, the inherent sluggishness to repair in the above-named areas is exaggerated   The fractured ends of the bone are dense, hard, and brittle, with no resemblance to normal architecture of bone   They are covered by tough adherent white fibrous tissue, containing no bone-forming elements   The periosteum, too, is replaced by fibrous tissue, and being very adherent does not easily peel off the bone, as does normal periosteum   The medullary canal is closed with hard brittle bone   This condition extends a variable distance from the line of fracture, and the ends of the bone are sometimes conical   The line of fracture is transverse or slightly oblique, either from the original injury, or more often from loss of bone fragments by sequestration or exfoliation in an originally comminuted fracture   The fractured ends are in apposition, and alinement is good, this having been brought about in most cases by the performance of unsuccessful operative measures such as wiring, plating, or bone grafting   The surrounding soft tissues are adherent together and to the bone by fibrous tissue   This tissue bleeds readily, and the bleeding, coming as it does from numerous small vessels, is difficult to arrest   It imperils success in operative treatment

Class II   Cases in which there is Want of Apposition, with Gap, from Longitudinal Displacement (*Figs* 401, 419) — These are due to loss of bone fragments by injury, operative removal, or infection, with perhaps prevention of apposition by a rigid parallel bone which holds the fractured ends apart, as in the leg and forearm (*Fig* 405)

The pathological condition of the bones found at operation is similar to that described above in *Class I*   The gap between the ends varies, and is filled with fibrous tissue It is very rare, if it ever happens, that such intervals can be bridged by regeneration of bone in forearm and leg   It is only in the lower end of the shaft of the femur that such a process is at all common, and here we have seen a gap of two inches bridged by new bone

A considerable proportion of the cases which form the subject of this communication had been subjected to the following methods of treatment at the hands of others, but bony union had failed to occur —

Non-operative Treatment   (1) Damming and percussion of Thomas , (2) Jamming the fractured ends together , (3) Ambulatory treatment on a caliper splint

Operative Methods   (1) Wiring, (2) Plating, (3) Bone graft

In some, these operations had been so often repeated with resulting failure, that the case was considered hopeless, and imputation had been suggested before they came under our care

Fig 405 —Showing non union of radius from the loss of bone between the fractured end and want of apposition with longitudinal displacement and gap due to the intact parallel bone the ulna

TREATMENT

The following procedures resulted in firm union

Class I   **Where Apposition Obtains** —For example, in non-union of the middle two fourths of the humerus

1   A preliminary operation is performed in which fibrous tissue in soft parts is excised, and intervening fibrous tissue between the fractured ends removed with a sharp scalpel The unhealthy bone at each end of the fracture is then removed, by an osteotome for preference in such a manner that the fracture line is now bounded by healthy bone and the medullary canal laid open   Care is taken that no loose or detached fragments of bone are left in the wound   The wound is closed, special care being taken to avoid and arrest

hæmorrhage   Fixation of the limb by external strapping and splinting is so applied that the two fractured and freshened ends are pressed firmly together (*Fig* 415)   This preliminary operation is performed as a safeguard against, as well as a test for, latent infection   It need not, therefore, be performed in the case of simple fractures which have failed to unite   Should infection occur after this preliminary operation, there are no fragments of bone to sequestrate, therefore suppuration will be of short duration   Should infection not occur, the second operation is simplified, and success is more likely

2   The second operation follows after an interval of three weeks if the wounds in the first have healed without infection   A suitable incision exposes the line of fracture   The ends of the bone are freshened and the medullary canal well exposed, and then one of two methods is adopted in the further treatment of the bone

a   First Method (*Fig* 417)—A 'step of 1½ in is cut from each end of the bone on opposite sides so that the raw areas left will approximate when brought together   Thus wide areas of healthy bone are held firmly in contact

b   Second Method—The bone for 1 in on each side of the fracture line is comminuted   This is done with osteotome or bone-cutting forceps, the former being necessary in the femur because of its hardness   The comminuted fragments are roughly ½ to 1 in long by ¼ to ½ in thick   They are loosened but not detached, and with dissecting or artery forceps, while the ends of the fracture are pressed together, they are overlapped, interlocked, and mortised   Great care is taken to preserve the periosteum, and it need never be stripped   Bleeding is then arrested, and the deep tissues are sutured accurately over the comminuted and artificially impacted bone   The bone is thus encased in soft parts is in a tube, and fragments are prevented from straying

The limb is fixed by splinting   and various external devices are used to hold the comminuted ends of the bone jammed firmly together   Constant daily care and attention are required in the after-treatment to ensure that the fragments are maintained pressed together in this position   X rays are used freely to confirm correct position   After about two weeks there is no tendency for the ends to separate, the fracture being well set round by organizing tissue   The position of fragments must, however, be maintained by splinting till union occurs

Class II   **Where there is Want of Apposition**—Longitudinal displacement with wide separation of fragments, as for example in loss of bone in the shaft of the humerus (*Figs* 401, 415)

1   After a preliminary operation of excision of fibrous tissue, the freshened fractured ends are brought together and held firmly in apposition by splinting, bandaging, and strapping of the limb

2   A second operation follows in two to three weeks, and consists of comminution and impaction of fractured ends, or overlapping after a step has been cut in each end

If an unfractured parallel bone is preventing apposition—as for example in non-union of the tibia with gap between fragments—the fibula may be divided and the two ends of the non-united fracture in the tibia thus brought together   Comminution of fractured ends, or overlapping after a step has been cut in each end, is practised, and the limb is put up in such a way that the fragments are held firmly pressed together (*Figs* 405, 418)

The advantages of this treatment are at once apparent —

1   A transverse or slightly oblique fracture becomes an impacted comminuted fracture   a fracture which nature always repairs—or, in the step operation, a longitudinal fracture   Fresh healthy raw bone surfaces are brought into apposition, and the total raw areas in apposition greatly increased with the minimum amount of shortening

2   The reparative processes of bone are stimulated by the severe trauma employed   In some localities above described, where failure of union after many operations to bring it about indicates inherent lethargy of repair, the stimulus of trauma caused by comminution is essential   anything less than this proving insufficient

3   The amount of interference with soft parts is a minimum   only an incision to expose the fracture being necessary

4 The operation is simple compared with the elaborate methods of bone grafting, plating, and wiring, requiring as they do special apparatus

5 No healthy bone or periosteum is removed in the comminution operation

6 No foreign bodies are introduced

Figs 406, 407, 408 show the limbs resulting from these operations In observing the length, due allowance must be made for the loss of bone before our operations to cause union were practised All soft structures shorten after these procedures, and muscles become quite strong It is only when infection has occurred that function is restricted by adherent fibrous tissue

It appears to the authors that previous failures following plating and wiring might be thus explained The operation of plating and wiring reproduces the same transverse or slightly oblique fracture which natural processes have already failed to repair It obviously places too great value on non-fixation of the fractured ends as the cause of non union, whereas in the type of fracture dealt with, fixation was not at fault, the ends of the fracture being in perfect apposition and adequately maintained by external splinting Moreover, the fixation which plating and wiring produced failed to bring about union The fact is overlooked that the stimulus of trauma produced in the operation of plating and wiring, and in some cases of bone-grafting, is not sufficient or widely enough distributed to stimulate reparative changes, nor are the raw bone areas which are in contact extensive enough in a transverse plated or wired fracture Indeed, plates may prevent the apposition of the fractured ends by holding them apart This result is observed in the humerus and in parallel bones The strong vertical muscles of the thigh usually hold the fractured ends of the femur together firmly when alinement is restored , hence plates do not hold them apart, and therefore union is the rule in these simple plated fractures

CONSIDERATION OF INDIVIDUAL BONES

Humerus —Non-union with undisplaced fractured ends is perhaps more frequent in the humerus than in any other long bone It occurs after simple fracture of the transverse or slightly oblique type, in the middle two fourths of the shaft Non-union is more likely to occur, however, in infected compound fractures Extension of the limb by its own weight or by apparatus is sometimes found to be a factor in the previous method of treatment , but in many, wiring and plating had been practised and the fragments were in perfect apposition but still ununited Comminution into several fragments by the original injury always allows of a good prognosis for union in simple fractures of this area

Another type of non union has come under our notice In it there is want of apposition by longitudinal displacement with gap, 2 to 3 inches or even more of the shaft having been removed by the initial injury radical excision, or infective process We have been struck with the readiness with which union has been obtained by the methods above described between the remaining ends in this type, giving a very useful but short arm Perhaps this happy result occurs because the middle two-fourths of the shaft, inherently sluggish in repair, has been removed, leaving the upper and lower fourths, where regeneration of bone is more prone to occur

Femur —Repair of bone in the shaft of the femur is perhaps more satisfactory than in any other long bone , indeed repair in the lower third of the femur is more satisfactory than in any other part of the body Non-union is very rare, and infection is largely responsible for the absence of the reparative process when this occurs Non union in the middle third of the shaft of the femur does occasionally happen In three cases under our care the line of fracture was oblique and long with gap, but the intervening space between was not entirely bridged by new bone These cases still infected are not in a suitable condition for further procedures to bring about repair

Non-union occurs in the upper third of the shaft, and the appearance is very typical (see Fig 103) Many instances arise where, after fracture, callus formation in this

region is not only abundant but excessive, particularly in mal-union and after osteotomy, so it would appear that infection is the factor mainly responsible for the failure of repair in this area. At the lower third of the shaft of the femur regeneration is at its best, and
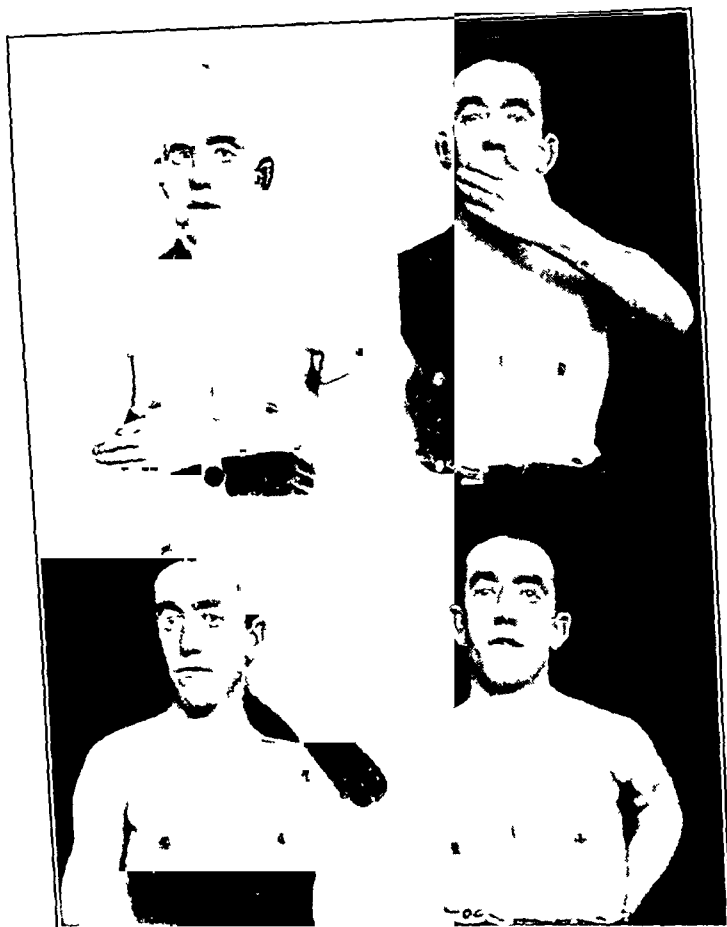
FIG. 404.—Case 2. Showing the excellent function in the shortened arm—the man being able to perform these movements quickly and without difficulty. Amputation had been advised.
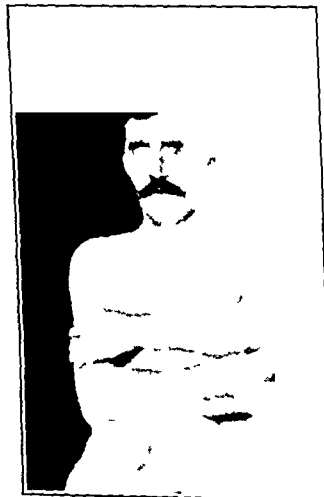
FIG. 405.—Case 1. Shows shortening of left arm after union of fracture had occurred.

an interval of 2 inches has been bridged after loss of bone with longitudinal displacement of fragments with gap

Non-union of the femur should not be diagnosed till ambulatory treatment with walking caliper has excluded delayed union, then it is wise to treat the fracture by comminution Bone-grafting is unsatisfactory, because it is unequal to the strain of body weight Union followed the operation of comminution Other methods of treatment such as wiring, bone-grafting, and ambulatory treatment on a walking caliper, had been tried elsewhere, but had failed to give the desired result

In one of our cases where the two stage operation was not practised, virulent infection followed comminution Some comminuted fragments sequestrated and had to be removed, but union ultimately occurred

Tibia —

Class I —In the lower third of the tibia there is an inherent tendency to non union although apposition is perfect The ends of the bone are in contact The line of fracture is transverse or slightly oblique Non union may occur at any age indeed a fracture in this region following osteoclasis in a child remained ununited after ambulatory treatment on a caliper walking splint, and after plating, wiring, and bone-grafting

Class II (Fig 419) —In non united fracture of the tibia, want of apposition is usually the cause Displacement is longitudinal, with a wide gap between the ends due to loss of bone having occurred through the initial injury, operative removal or infective process, the ends of the fracture being withheld from apposition by the rigid parallel bone the fibula This may occur in any part of the tibia with resultant non-union for there is not that tendency to bridge an interval in the tibia that is so often seen in the lower end of the femur

TREATMENT —The treatment of these two types of non-union is different

Class I — Comminution into fragments, with overlapping and impaction of the fragments, is attended with success

Class II — (1) Want of apposition can be corrected by division of the fibula, the fractured ends are then freshened, a 'step is cut out at each end or comminution practised and the healthy extensive raw surfaces are kept firmly pressed together After union the patient is fitted with a high boot (2) Bone-grafting (Fig 409) This method has the advantage of returning the original length of the limb, and may be chosen in many cases but the strength of the resulting union does not compare favourably with that following union after the preceding method Re fracture is not infrequent, and adequate protection of the graft demands many months of after-treatment and restricted use of the limb yet we have had many satisfactory functional results after bone grafting

Fig 409 —Showing non union with gap in tibia successfully treated by bone-graft

Radius and Ulna —

Class I —It is very rarely that repair fails to follow transverse or slightly oblique fracture with apposition in these bones and non union of this type is very uncommon

Class II (Fig 405)—Non-union is common and mostly follows want of apposition of the fractured ends, with gap through loss of bone by the initial injury, operative removal or infection The parallel unfractured bone prevents the fractured ends from coming into apposition There is no tendency for callus to bridge the gap thus left

TREATMENT —

Class I—Comminution or bone grafting is recommended

Class II—Bone-grafting proves satisfactory, for the stress and strain laid on the graft is not as great as in the lower limbs

ILLUSTRATIVE CASES

Case 1 —N   age 45   (Figs 408, 410 411 412)

Nov , 1918   Sustained a simple transverse fracture of the left humerus at junction of middle and lower third   Non union resulted   Jan , 1919   Fracture plated   Non union resulted   May   Plate removed   Aug   Fractured ends excised and stepping operation performed, the fragments being held firmly in position by wiring   Result, non union   April, 1920   Wire removed

It was after this stage that the patient first came under our care
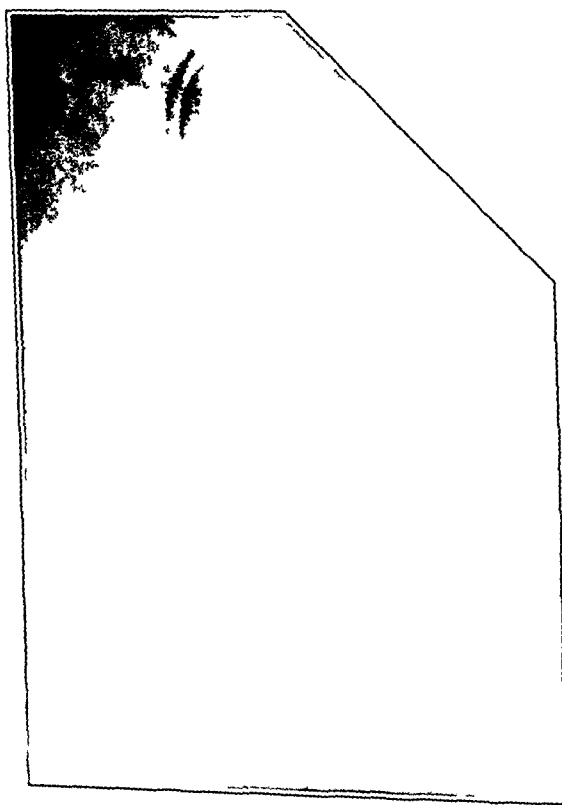
FIG 411—Case 1   Showing ununited fracture of humerus with consolidation backward
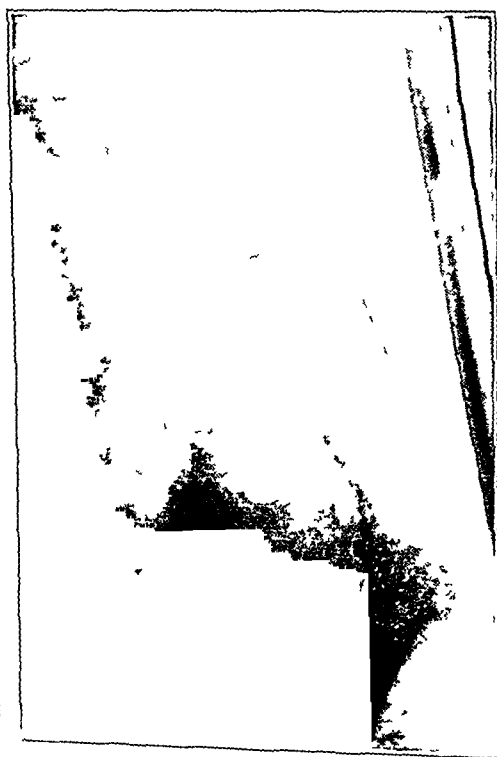
FIG 411—Case 1   Illustrates the communuted and impacted fracture

Sept 1920   The ends were comminuted and the arm put in abduction plaster   Non-union resulted   Note   impaction was *not performed at operation or in after-treatment*   Feb , 1921   The ends were comminuted and impacted   but owing to circumstances over which we had no control impaction was not maintained in the after treatment   Non union resulted   July 1921   Opera tion of comminution and impaction   Impaction maintained by splinting stripping, and careful after treatment   Result union
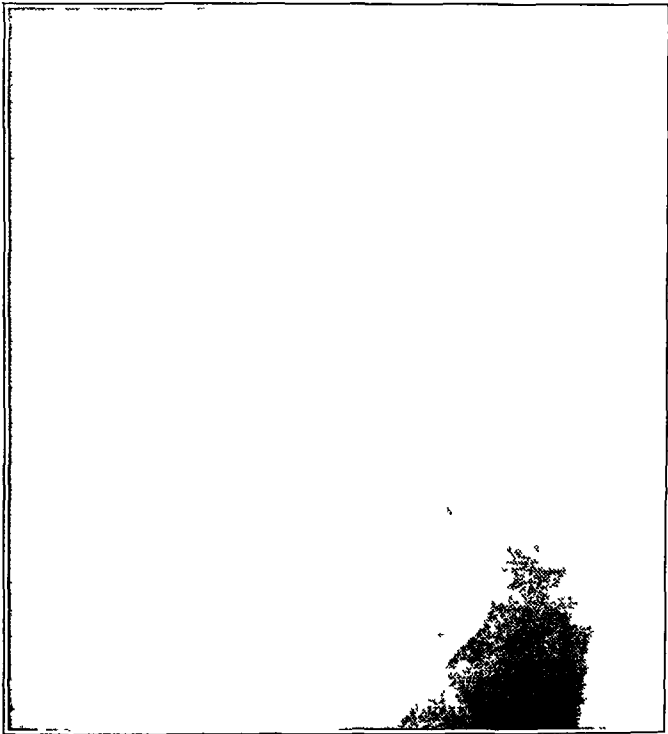
FIG 112—*Case* 1 Shows firm union The posterior angulation deformity still persists but functional alinement is good
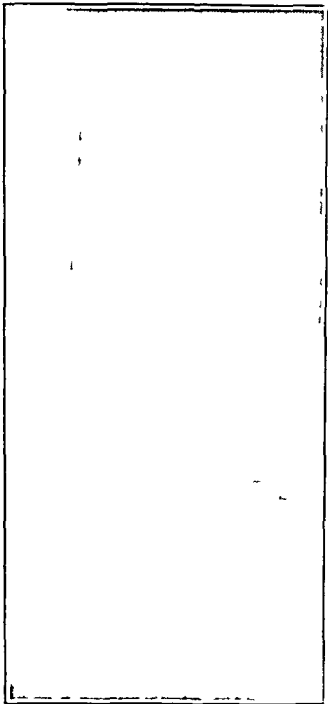
FIG 413—*Ca* X ray picture of fracture before final operation with loose plate still *in situ*

FIG 414—*Case* 2 X ray picture long after union had occurred, showing abundant firm callus

Case 2 —F C , age 24 (Figs 413, 414)

Jan , 1918   Sustained simple fracture of the middle of shaft of right humerus   Non union resulted   Jun 1919   Step operation performed   Result, non-union   Oct , 1919   Plating of fracture   Result, non union

After this stage the patient first came under our care

Jan , 1920   The seat of fracture was exposed by operation   The ends were comminuted and impacted   Result, firm union

Patient writes later   ' I have been riveting steel shutters with a 4 lb hammer for three months '
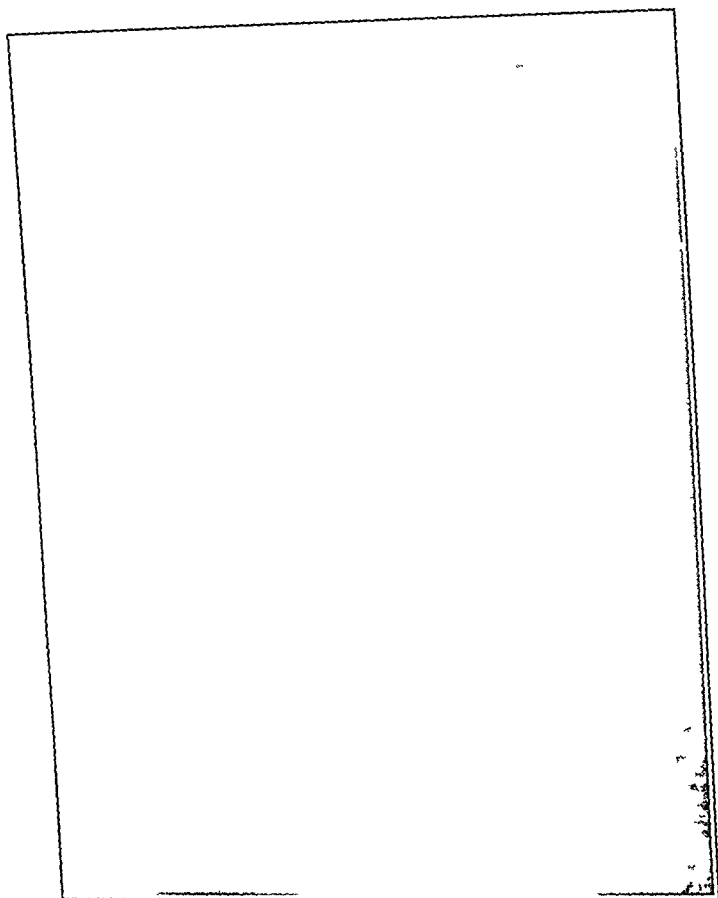
Fig 413   Case 2   X ray picture showing the united fracture the small head fragment, and the short part of the remaining portion of the shaft

Case 3 —H , age 28 (Figs 406, 413)

Nov 1918   Sustained a gunshot wound of upper arm causing compound comminuted fracture of left humerus   Four subsequent operations for the removal of sequestra were performed   Non union resulted with the loss of 3 in of the upper half of the shaft of the humerus and a 3 in gap between the fractured ends

After this stage the patient first came under our care

July 1919   The fractured ends were exposed and the scar tissue in bone and soft parts excised   The freshened ends were then jammed together and held firmly in position by strapping and splinting   Result firm union in four weeks

Note — This operation was done as a preliminary to a subsequent comminution and impaction operation but happily union resulted and the secondary operation was not needed
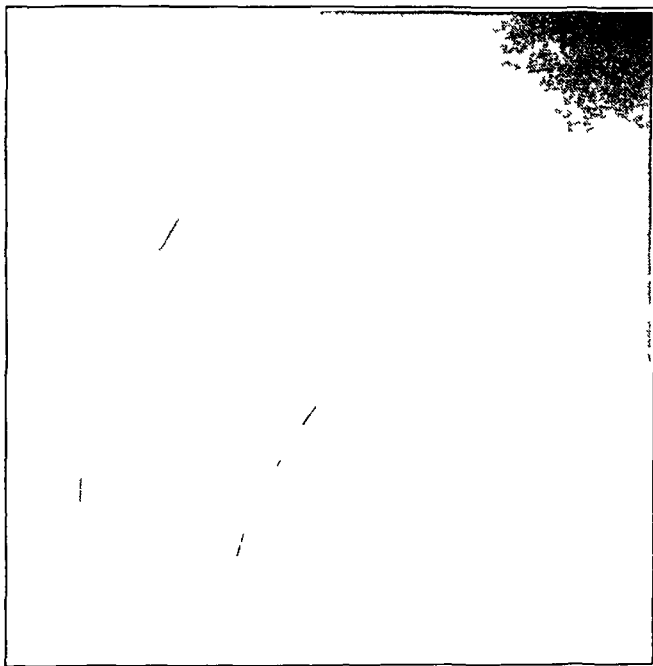
FIG 416 — Case 4   X ray picture after union had occurred

Case 4 —G , age 20 (Fig 416)

Aug , 1917   Sustained gun shot wound of the left thigh with compound fracture of the upper third of femur   Dec   Wound healed after six operations for removal of sequestra, but non union resulted   Feb , 1918 Fractured ends freshened and wired   Fitted with walking caliper   Result, non union   March 1919   Bone grafting performed Nine months on walking caliper Result, non union

After this stage the patient first came under our care

May, 1920   The fractured ends were exposed and scar tissue and bone excised   The freshened bone ends were comminuted and impacted   Impaction maintained   Result, firm union

Case 5 —L , age 26 (Figs 417, 418)

March, 1919   Sustained gunshot wound of left leg, with compound fracture of tibia and fibula   Wound healed, but non union resulted in tibia the fractured ends being separated by a gap

After this stage the patient first came under the care of one of us

FIG 417 —Case 5   X ray picture taken after operation
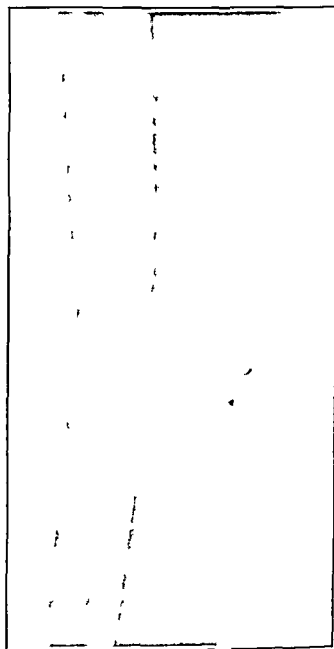
FIG 418 — Case 5   X ray picture taken after firm union had resulted

Feb 1920 The seat of fracture was exposed and a step cut out of each end of the fractured tibia The fibula was then divided obliquely and the steps on the tibia overlapped Result, firm union

Case 6—J, age 26 (*Figs 419 420*) A Syme amputation had been performed satisfactorily Sustained multiple gunshot wounds The tibia and fibula of his *right* leg sustained a compound on his *left* leg, with resulting shortening
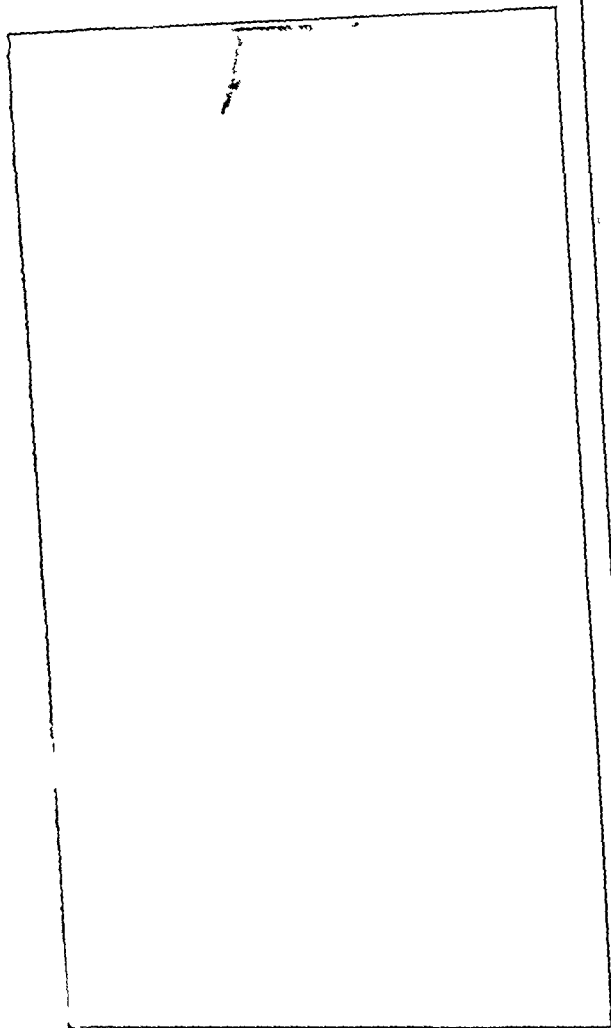
FIG 419 —Case C Shows ununited fracture of tibia in upper third marked displacement and gap between end Also fracture of the fibula has united with deformity after

FIG 420 —Case C Shows firm union with good alinement of tibia and fibula but much shortening

comminuted fracture at the junction of upper and middle thirds Union of fibula occurred, with a gap separating the fractured ends of the non united tibia There was prolonged suppuration, and much scar tissue in soft parts

At this stage the patient first came under our care

The tibula was divided obliquely The extensive scar in soft parts was excised as well as that in the fractured ends of the tibia Comminution and impaction was practised Infection and suppuration occurred Firm union resulted

Case 7 —B , age 28 (Fig 121)

Nov , 1917   Sustained gunshot wound of middle third of right humerus   Nineteen subsequent operations were performed for the removal of sequestra   Non union of the fractured ends resulted   June, 1918   Plating performed   Result, non union   Jan , 1919   Plate removed   Replated   Result, non union   Oct , 1919   Plate removed   Replated   Result, non union

After this stage the patient first came under our care

March, 1920   The fractured ends were exposed by excision   Scared bone was excised, and freshened ends comminuted and impacted   Suppuration followed, many sequestra were removed, but firm union resulted
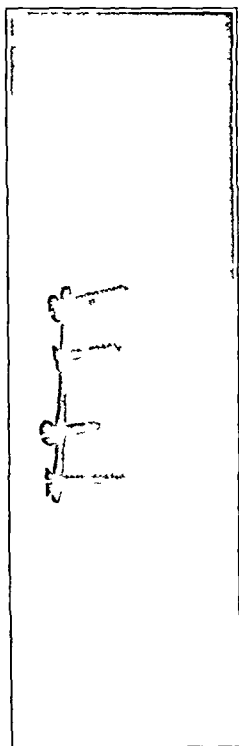
Fig 421 —*Case 7*   X ray picture showing non union of fractured humerus with plate in position
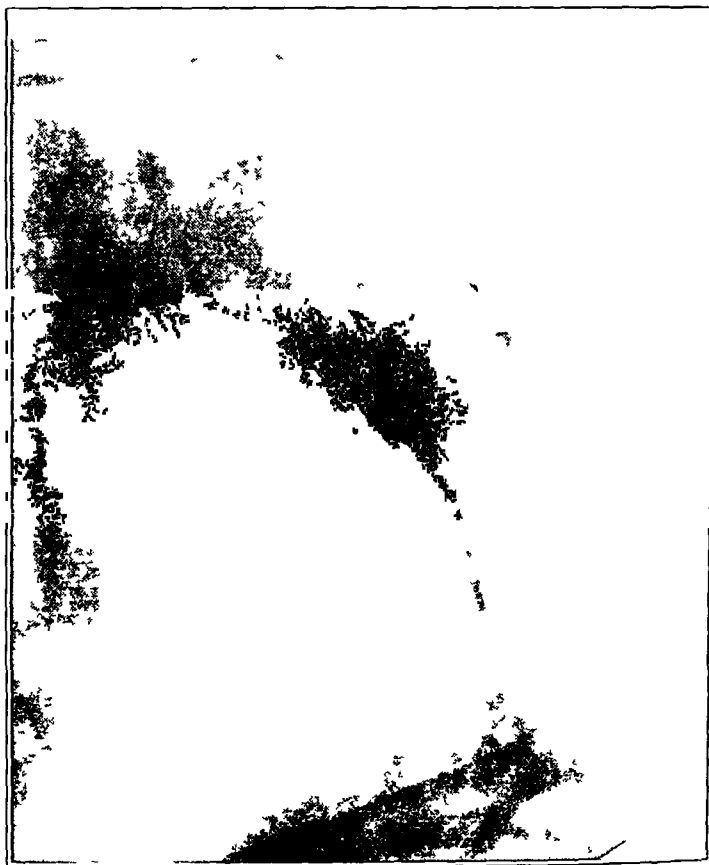
Fig 422 —*Case 8*   X ray appearance after firm union has resulted

Case 8 — M , age 30 (Figs 407, 422)

April, 1917   Sustained a gunshot wound causing compound fracture of junction of upper and middle thirds of the left humerus   Eight subsequent operations for the removal of sequestra were performed   Non union resulted   Jan , 1919   Bone grafting was performed   Result, non union

After this stage the patient first came under our care

Sept , 1920   The line of fracture was exposed by operation and scared bone exposed   The freshened ends were then comminuted and impacted   Splinting and careful after treatment maintained the impaction   Union occurred in four weeks

Case 9 — C J age 58 (Figs 402, 423, 424)

Feb 1920   Sustained simple comminuted fracture of middle third of right humerus   The bone was broken into three fragments distal proximal, and a small intermediate triangular fragment apparently broken off the proximal portion   Non union resulted although treatment was satisfactory   The small intermediate fragment united with the upper fragment, and a transverse ununited fracture remained

Feb., 1921. One year after the initial injury the fracture was exposed by a suitable incision. The ends of the fractured bones were freshened, comminuted, and impacted. Splinting and after-treatment were so arranged as to maintain impaction and alinement. Firm union resulted

Fig. ... —Case 9. X ray picture taken soon after operation. The comminution are well shown. The metal trough splints

FIG 421.—Case 9. X ray picture taken after firm union had resulted

Case 10. R. R., age 26. Sept. 1917. Sustained gunshot wound of right arm causing compound comminuted fracture of humerus at junction of lower and middle third. Many operations were performed before the wounds healed, but non-union resulted. Bone-grafting was practised resulting in non-union. Sept. 1919. Steps were cut in the fragments; these were approximated and pegged, and later bolted together. Result non union.

After this stage the patient came under the care of one of us.

Nov. 1920. Operation. Scarred bone excised till healthy cancellous bone presented. With chisel and mallet the lower fragment was fashioned so that it could be impacted, 'telescoped', or driven into the gouged out fractured end of the upper fragment. This impaction was maintained by splinting and stripping throughout the after treatment. Result, union

CARCINOMA OF THE JEJUNUM AND ILEUM

By RAYMOND JOHNSON London

THE present communication deals only with carcinoma of the jejunum and ileum and does not include growths in the duodenum or ileocœcal valve   In the latter situation the disease is not very rare, but in the duodenum, if carcinoma of the ampulla of Vater is excluded, it is almost unknown   This extraordinary freedom of the duodenum is not only true of primary growths, but is also well seen in the behaviour of pyloric cancer which, whilst spreading freely into the adjacent stomach wall, is almost invariably abruptly limited on the distal side, and shows little tendency to spread into the duodenum

The rarity of carcinoma in the jejunum and ileum is well recognized, and it appears not uncommon for a surgeon of wide experience to pass through his career without meeting a single case   In this part of the intestine cancer appears to be more common near the extremities than elsewhere, but it is much less rare in the lower part of the ileum than in the upper part of the jejunum

Published statistics illustrating the sites of election of intestinal cancer are numerous, and give striking evidence of the rarity of the disease in the small gut   Thus, among 41,838 autopsies performed at the Vienna General Hospital, 3585 were cases of cancer, of these, 343 were intestinal, 10 being in the ileum but none in the jejunum   Among 584 carcinomas of the intestine collected by Hinz[1] from the records of various pathological institutes, 18 (3 08 per cent) were in the small intestine, excluding the duodenum   The fluid nature of the contents, and the absence of abrupt bends in the small intestine, may be important factors, whilst the very different nature of the contents and the liability to stasis may, in part it least, explain the frequency of the disease in the large gut

Three personal cases—two jejunal and one ileal—illustrate some clinical aspects of the disease

Case 1 was that of a married woman, 46 years old, who for two or three months had complained of pain in the upper abdomen, not related to the taking of food   Soon occasional vomiting occurred, and increased in frequency up to six or eight times daily   The vomited matter was bilious, there was no hæmatemesis   Constipation was obstinate, and enemas brought away only small hard masses, there was no history of melæna or the passage of mucus   The patient always thin, had lost weight slightly

On abdominal examination very marked peristaltic movements were visible above the umbilicus, the abdominal wall being frequently raised into a prominence in the middle line and the waves of contraction passing across it in a direction from right to left (*Fig* 425)   During the occurrence of the contractions, gurgling was very obvious   In other respects abdominal examination revealed nothing abnormal, and rectal examination was negative   The presence of such extremely well-marked visible peristalsis indicated without doubt that a mechanical obstruction was present, and that operation was imperative   In considering the probable seat of the obstruction, the conclusion was made that it was most likely in the small intestine   The pylorus was excluded because of the direction of the peristaltic wave and the absence of any relation between the vomiting
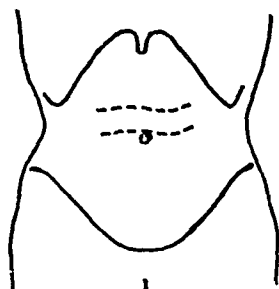
and the taking of food   On the other hand, an obstruction in the large intestine causing such a degree of visible peristalsis would have been expected to cause also a considerable degree of abdominal distention and not such urgent vomiting   Further information could no doubt have been obtained by special methods, but it was not thought well to postpone operation while these were carried out

Accordingly, on Oct 8, 1908, the abdomen was opened above the umbilicus, and an intussusception of the small intestine was at once exposed   The upper end of the intussusception was about 18 in below the duodenojejunal flexure   The bowel was not congested and the intussusception was very easily reduced   A firm rounded tumour
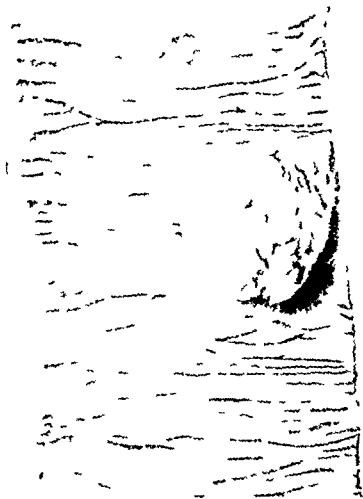
Fig 426 —Carcinoma of jejunum (Case 1)
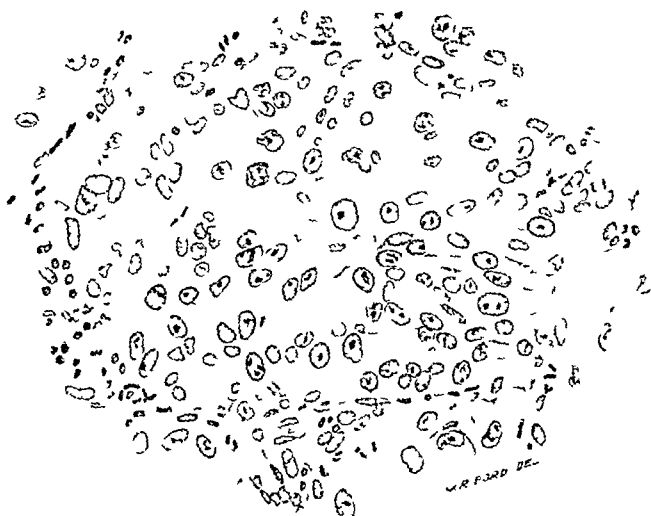
Fig 427 —Microscopic section of the tumour in Fig 426

could then be felt in the lumen of the gut and at the site of its attachment the peritoneal surface presented a small rounded depression, caused by the traction of the growth   Resection was performed and an end-to end union made   The patient recovered normally, and six years later was known to be well

The tumour is illustrated in *Fig 426* and the microscopic structure in *Fig 427* *

Case 2 occurred about five years later, and was that of a man, age 32 who was admitted into University College Hospital on Oct 23 1913   The symptoms were of only two weeks duration, and consisted of abdominal fullness and vomiting, with a rolling sensation' in the upper part of the abdomen after taking food   The vomiting occurred about six times during the week before admission, usually about half an hour after food   There was troublesome constipation
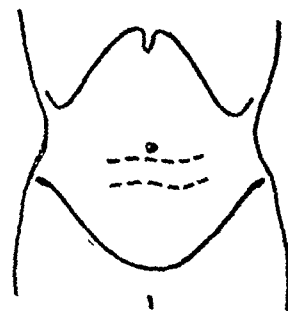
On admission the man's general condition was good   There was no general abdominal distention, but from time to time a transverse swelling appeared below the umbilicus (Fig 428) it persisted for about thirty seconds and peristalsis was very evident in it, but the direction of the contractions was not obvious   Distention of the stomach (by giving tartaric acid and sodium bicarbonate) showed it to be lying in its normal position, and distention of the colon with or did not affect the peristalsis in the distended

Fig 428

coil   X-ray examination showed some delay in the emptying of the stomach, a small quantity of bismuth still remaining in it after six hours   In view of these findings it seemed probable that the obstruction was situated in the small intestine

On opening the abdomen to the right of the middle line, the distended coil above described proved to be part of the jejunum greatly distended and hypertrophied above a nodular annular stricture, looking externally as if a piece of string had been tied around the bowel   On the peritoneal surface of the bowel were some minute nodules of the size of a pin s head   and looking more like tubercles than growth   The mesenteric glands were not enlarged   The growth was situated between three and four feet from the duodenojejunal flexure   Twelve inches of the gut were excised, and, in view of the great difference in diameter of the proximal and distal ends, a lateral anastomosis was made   The patient made a normal recovery   but after remaining well for several months he began to experience abdominal pain, and in   July, 1914   a medical man who saw him found the liver much enlarged and its surface marked by large projections, evidently of growth   Other masses could also be felt in the abdomen   Death occurred on Aug   12, nine and a half months after operation
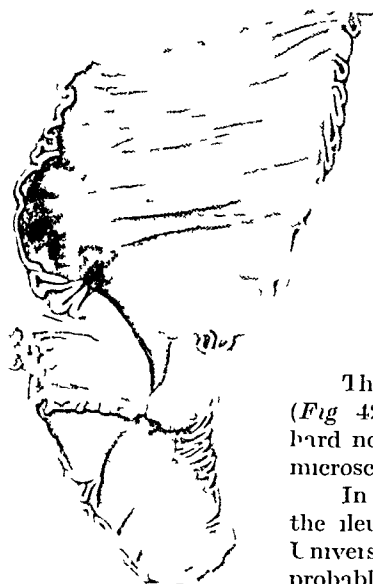
The tumour in this case formed a typical ring stricture (*Fig* 429), the lumen being almost completely obstructed by a hard nodular growth, the surface of which was ulcerated   The microscopic structure was that of a columnar celled carcinoma

In *Case* 3 the growth was situated in the lower part of the ileum   The patient, a woman, age 32, was admitted into University College Hospital on Sept 14 1917, as a case of probable pyloric obstruction   The history was that for six months she had suffered from abdominal pain, chiefly in the umbilical region, with occasional vomiting   The pain occurred in attacks, usually starting shortly after taking food, and when vomiting occurred it relieved the pain   The latter gradually increased in severity, and the vomiting became more frequent and more copious   Flatulence was distressing, and there was much sensation of gurgling in the abdomen   Constipation also became increasingly obstinate   The patient's health previously to the onset of the present illness had been good, and there had been no earlier abdominal symptoms   Two weeks before admission the woman had been delivered prematurely at seven and a half months

Fig   429.—Carcinoma of jejunum (*Case* 2)   The specimen includes only part of the bowel removed

On admission, she was much wasted   The abdomen was distended, and four or five coils of intestine showed clearly through the abdominal wall as transverse prominences (*Fig* 430,)   Visible peristalsis was very marked and commencing just above the pubes, progressed upwards in distinct waves   There was considerable shifting dullness in the flanks   Tenderness was present above and to the right of the umbilicus, and much splashing and gurgling could be felt over the whole abdomen   No tumour could be felt by abdominal or rectal examination   The patient's condition rendered any investigation by bismuth meals, etc , impossible, but the diagnosis of pyloric obstruction was at once negatived   The distention and visible peristalsis were

Fig 430

evidently in the small intestine and not in the stomach, and malignant disease of the large intestine seemed to be the most probable cause of the obstruction

The abdomen was opened by a right rectus incision, and coils of greatly distended
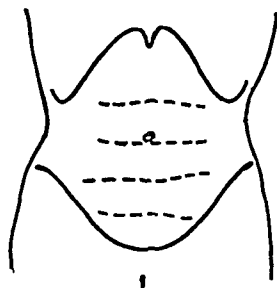
small intestine were at once exposed   There was no free fluid in the peritoneum   The distention of the gut stopped at a point six inches above the ileocæcal valve where there was a very hard growth in the gut, feeling extraordinarily like a Murphy's button uniting the distended and hypertrophied bowel above to the pale and contracted bowel below The coils of the distended bowel filled with fluid contents were evidently the cause of the shifting dullness, which had suggested the presence of free fluid

In the presence of such a degree of obstruction immediate resection was considered inadvisable, and an artificial anus was therefore made a short distance above the growth, and a Paul's tube inserted   Twelve days later a second operation was performed and about 13 in of the ileum were removed, including the growth and artificial anus together with the corresponding part of the mesentery, the lower section of the bowel being made 1 in above the ileocæcal valve   The two divided ends of the ileum were closed, and a lateral anastomosis was made between the proximal loop and the ascending colon

The patient remained in hospital for five months after the operation on account of her very weak and emaciated condition, almost certainly due to secondary deposits in the abdomen, and when transferred to an Infirmary it seemed unlikely that a fatal result would be long delayed

The tumour in this case formed a tight annular stricture; microscopically it was a columnar celled carcinoma, and one of the mesenteric glands contained a deposit of similar growth

In reviewing these three cases it may be pointed out that in none of them was a correct diagnosis made before operation although in two of them it was thought probable that an obstruction was present in the small intestine   Indeed, carcinoma of the jejunum or ileum is so rare that it is hardly likely to receive serious consideration in an obscure case of actual or impending obstruction   When the case presents itself as one of more or less complete obstruction, special investigation before operation is hardly possible although x-ray examination after the introduction of a barium enema might exclude obstruction in the large intestine with some certainty   In several instances, as in the last above recorded, the case has been regarded as one of pyloric obstruction

A prominent feature in each case was the marked visible peristalsis, and a study of recorded cases shows, as might be expected, that this sign is very commonly present Speaking generally, it may be said that visible peristalsis is a certain proof of mechanical obstruction, and is also a proof that the obstruction has existed long enough to cause a considerable degree of muscular hypertrophy in the bowel above it   In comparing the case of cancer of the lower ileum with those in which the growth was in the jejunum an interesting difference is observed   In the two cases of jejunal cancer the distention and visible peristalsis were limited to a single coil lying transversely, in one case above and in the other immediately below the umbilicus (*Figs 425, 428*)   In the former of these the distended viscus might from its position have been the stomach, but that the peristaltic waves in it passed very constantly from right to left   In the case of cancer of the lower ileum, on the other hand, the aspect of the abdomen was very different; there was considerable general distention and the 'ladder' arrangement was very marked, the peristalsis being seen in four or five separate transverse coils, lying partly above and partly below the umbilicus (*Fig 430*)

Incidentally, I may refer again to the fact that in this case there was very marked shifting dullness, although at the operation it was shown that there was no free fluid in the peritoneal cavity   This sign was evidently due to shifting of the coils of gut loaded with fluid contents and was clearly demonstrated when the abdomen was opened by the way in which the distended coils behaved when drawn out of the incision   The point seems to be one of clinical interest

A study of some of the recorded cases of carcinoma of the jejunum and ileum shows that the symptoms before the onset of complete obstruction, are almost constantly abdominal pain, vomiting, increasing constipation and often rapid emaciation   The pain is usually paroxysmal, and, if visible peristalsis is present, will be found to be coincident

with the contractions of the distended bowel Vomiting is very constant and, like the pain, may or may not be associated with the taking of food Although it might be expected that the higher the disease the more marked would be the relation of the pain and vomiting to food, a study of recorded cases shows that this evidence is often misleading The pain is often accompanied with much gurgling, obvious both to the patient and the surgeon Constipation is generally mentioned as increasingly obstinate, but the irregularity of the bowels, with the occasional passage of loose stools, so common in cancer of the colon, appears only very rarely to occur The detection of blood in the stools is exceptional, but is said to be more common in the stenosing form of growth

The discovery of an abdominal tumour before operation is rare, and when present it is hardly possible that its position or characters will serve to indicate its nature In a case under the care of Batty Shaw in University College Hospital, the specimen from which is preserved in the Museum, the growth, which was situated three feet from the duodeno jejunal flexure formed a hard fixed mass in the left iliac fossa It is interesting that in another case of malignant disease of the jejunum, which was admitted to the Hotel Dieu, Paris, on June 14, 1827 and a drawing of which, by Sir Robert Carswell, is preserved in the same Museum, the growth formed a hard fixed tumour in the left iliac region In this case the symptoms were of six months' duration, and the patient, a man of 44 died of perforative peritonitis

The duration of the symptoms before operation is very variable, in some cases extending to a year or more, and in others being only a few weeks In one of the cases above recorded, the patient was quite free from symptoms until two weeks before his admission to hospital, although the growth formed a very tight ring stricture of the jejunum The fluid nature of the contents of the small intestine doubtless explains this occasional absence of symptoms until the obstruction has become almost complete It is less surprising than the fact that a similar absence of symptoms may be met with in carcinoma of the colon until an acute obstruction occurs

It has already been pointed out that in the majority of cases a correct diagnosis can hardly be made before operation The mistakes likely to be made are well illustrated by several of the 52 cases of carcinoma of the jejunum and ileum abstracted by Hinz[1] of which four are personal In several instances carcinoma of the stomach, and in two at least duodenal ulcer, was diagnosed The latter diagnosis was made in the case of a man, age 32, who for a year had suffered from recurrent attacks of vomiting, with pain in the upper abdomen Death occurred after a severe attack of diarrhoea and vomiting lasting three days there was a carcinoma of the upper part of the jejunum In another recorded case a diagnosis of typhoid fever was made, the illness was of only three weeks' duration, and was marked by abdominal pain and varying diarrhoea Death was preceded by signs of peritonitis and examination disclosed the presence of a perforated carcinoma of the lower ileum

In a remarkable case under the care of Riese, and recorded by Hinz, an operation was performed for a strangulated right inguinal hernia Twelve days later vomiting returned and became faecal, and contracting bowel was felt in the right side of the abdomen A recurrence of strangulation was suspected, but operation revealed a long intussusception in the lower part of the ileum The intussusception was reduced, and part of the gut, containing a carcinomatous tumour as large as a hen's egg, resected

Strangely enough Riese had another case in which a woman, age 64, had undergone operations for umbilical and femoral hernias three years previously Abdominal pain of three days duration occurred, associated with resistance beneath the umbilical scar A diagnosis of strangulated umbilical hernia was made, but operation showed a large growth in the ileum with numerous adhesions

When the symptoms follow a previous abdominal operation, it is only natural that the cause of the obstruction should be suspected to be a peritoneal band or adhesion A specimen of carcinoma of the ileum from a case under the care of A E Barker, and preserved in the Museum of University College Hospital, is of interest in this connection In this case a woman age 36 double ovariotomy had been performed two years

previously There was a three months' history of paroxysmal pain in the lower abdomen, vomiting, constipation, and loss of flesh During the paroxysms of pain a transverse distended coil of bowel appeared below the umbilicus and subsided with much gurgling At the operation, 30 in of ileum were resected including two strictures 18 in   apart The upper stricture was caused by a columnar-celled carcinoma , the lower stricture was fibrous, and was situated at the point where the gut was adherent to a chronically inflamed appendix

The operative treatment of carcinoma of the small intestine, assuming the growth to be suitable for removal, must in the first instance depend on the presence or absence of actual obstruction In favourable cases the affected part of the bowel should, of course, be resected, together with the corresponding part of the mesentery Fagge[2] has recorded a case in which he successfully resected 8 in of the jejunum in which the growth was situated together with part of the colon to which the growth had become adherent In one of three cases of carcinoma of the jejunum under the care of Moynihan, and reported by Tatlow,[3] 2 in of the duodenum and 18 in of the jejunum were resected, a posterior gastrojejunostomy was performed, and the distal end of the duodenum implanted into the jejunum If the tumour is considered unsuitable for removal, a lateral anastomosis may be performed

In the presence of a marked degree of obstruction surgeons are agreed that immediate resection of intestine is almost certain to lead to disaster When such a degree of obstruction complicates a growth in the small intestine, especially high up, the outlook must be very grave An artificial anus should be made above the growth—a procedure attended with much danger to the patient, partly on account of the rapid emaciation likely to occur, and partly because of the damaging effect of the escaping contents of the bowel on the surrounding skin The latter may for a short time be prevented by the use of a Paul s tube, but the second operation for the resection of the growth must be carried out with as little delay as possible, the resected part of the gut including the artificial anus is well as the growth In the third case of my own this procedure was followed, the second operation being performed twelve days after the obstruction had been relieved by ileostomy

In speaking of the morbid anatomy of cancer of the jejunum and ileum it is necessary to insist upon the necessity of confirming the naked-eye appearances by a careful microscopic examination In this connection Venot and Parcelier,[4] in an exhaustive article on the subject, refer to two cases in which a stenosing tumour of the small intestine, believed to be a carcinoma, proved on microscopic examination to be tuberculous They also refer to a third case, observed by Chalier, in which multiple deposits in the small intestine, believed at the operation and subsequent autopsy to be tuberculous, proved to be colloid carcinoma

The disease in its more important features and in its mode of extension closely resembles carcinoma of the colon Four varieties of the primary growth may be recognized (1) The stenosing form, producing a ring stricture of the gut (*Fig 429*) , (2) The polypoid form, in which a rounded mass of growth projects into the lumen (*Fig 426*) , (3) That in which the growth is accompanied by extensive ulceration , and (4) Colloid carcinoma In at least two recorded cases multiple growths were present—four in number in each , the proximal growth being apparently the primary one, and the more distal growths being possibly the result of implantation In each of these two cases metastases were present, and the tumours were evidently not examples of the 'carcinoids' to be presently described

Reference has already been made to more than one case in which the growth caused in intussusception, and also to the fact that acute perforative peritonitis may result Intussusception appears to be more common in the polypoid than in the stenosing form of growth This complication occurred in a case, the specimen from which, presented by Rodriques, is preserved in the Museum of University College Hospital The tumour has a striking resemblance to that illustrated in *Fig 426* and was situated in the ileum 12 in above the ileocaecal valve The case is of special interest by reason of the complete

absence of previous symptoms   The patient, a man, age 42, was seized with severe abdominal pain and vomiting, and later in the same day the vomit was stercoraceous A tender sausage-shaped swelling was felt below the umbilicus, and proved to be an intussusception, which was easily reduced , the affected part was resected   Death occurred ten weeks later, and metastases were found in the mesenteric glands, liver, and right lung   The tumour was a spheroidal-celled carcinoma

The extension of the disease to the outer surface of the intestine may lead to a local ized abscess, or the gut may become adherent to some other part of the intestinal tract and a fistulous communication result   Voelcker[9] has recorded a case in which an ulcerated carcinoma of the jejunum led to the formation of a communication with the ascending colon , and in another case of carcinoma of the ileum   under the care of Keetley, it

Fig 4 1 —Carcinoma of the jejunum from a drawing by Sir Robert Carswell in the Museum of University
College Hospital London

opened into the rectum   In Voelcker s case the patient, a man of 33 appeared to be quite well until three weeks before his death—another striking illustration of the latent course sometimes pursued by the disease until the sudden development of obstruction or some other complication

Metastases are frequent, the most common sites being the mesenteric glands peri toneum, and liver   In one of the cases of multiple growths above-mentioned there were secondary deposits in the lungs and bones, and another in the spinal dura which caused compression of the cord at the level of the 2nd and 3rd dorsal roots

Histologically, carcinoma of the small intestine is usually of the columnar celled form but in some cases the structure is that of a spheroidal- or polyhedral celled carcinoma   In the two of my own cases in which the growth formed a ring stricture the structure was columnar celled and a deposit in a mesenteric gland in one of them was of similar structure   In the remaining case, in which the tumour formed a poly

poid mass projecting into the lumen of the jejunum, the cells were polygonal (*Fig* 127), and in another example of this form of tumour the structure was similar   The spheroidal-celled form of growth is probably the more malignant

Among a large series of water-colour drawings of morbid anatomy by Sir Robert Carswell, preserved in the Museum of University College Hospital, are three of carcinoma of the jejunum, in all of which perforation occurred   These drawings were made in Paris between 1828 and 1831   A sketch of one of them is reproduced in *Fig* 131 , in the dilated bowel above the growth are two small ulcers, which are probably stercoral and there is a growth in the mesenteric glands

Reference has already been made to the second case, in which the growth formed a hard fixed tumour in the left iliac region

There are also some interesting notes of the case from which Carswell's third drawing was made   The patient was a man, age 50, " of remarkably strong make and constitution   He had served for some time as a *sapeur* in the army, and wore an immense beard —his fine head, expressive eye, and aquiline nose, which the long flowing, slightly greyish beard rendered somewhat patriarchal, enabled him to gain an occasional livelihood by sitting as a model to painters "   He was admitted to La Charité complaining of failing strength bad appetite, and abdominal uneasiness, ' and appeared to have come in for bed and food rather than disease   On examination, however, a huge tumour was discovered in the upper part of the abdomen, and death occurred with signs of perforative peritonitis in thirty-two hours   There was a   cerebriform cancer of the jejunum , without actual obstruction, the bowel above and below the growth being funnel-shaped

In conclusion a short reference may be made to certain multiple tumours occasionally found post mortem in the small intestine, which, although presenting the minute structure of carcinoma show little if any evidence of malignancy   In 1904 Bunting[6] recorded in the *Bulletin of the Johns Hopkins Hospital* a case of " multiple primary carcinomata of the ileum '   The patient, a negro, age 52, died of heart disease, without any history of intestinal symptoms   Through a length of 50 cm of the upper ileum were scattered six firm opaque white nodules 3 to 7 cm in diameter, and covered by the mucous membrane   The nodules were composed of small, closely-packed, polymorphous cells which invaded the muscular layer , in one nodule a small group of the cells was found in the subserous tissue   Bunting referred to six other recorded cases of similar nature, in one of which the two nodules in the ileum were as large as cherries   In all these cases death resulted from other causes   Bunting was struck by the resemblance of the structure to that of the tumours described by Krompecher in his monograph on basal-celled cancer of the skin   These intestinal growths have been further investigated by Krompecher himself and form the subject of an article entitled " Basal-celled tumours of the cylindrical celled mucous membranes, with special reference to 'carcinoids of the intestine , to which Mr T W P Lawrence has kindly drawn my attention

The tumours in question, which consist of small spheroidal cells, are supposed to have their origin in the basal cells which lie between the cylindrical cells of the crypts of Lieberkuhn, and are met with in the intestine and vermiform appendix   They are allied to the basal celled tumours of the skin, and, like them, are of relatively low malignancy Krompecher admits that tumours of this structure may possibly also arise in pancreatic rests

In the intestine these tumours, which are usually quite small, are generally multiple they look like small scirrhous cancers, and not being circular do not cause stenosis   In structure they exactly resemble the tumours of the vermiform appendix, and, like them, rarely show any evidence of malignancy

According to this view the so-called 'carcinoma of the appendix which has such a very considerable literature is a carcinoid' or basal-celled tumour   Although true carcinoma of the appendix has been recorded, it has always been difficult to believe that the small yellowish tumours sometimes found in the appendix, usually in cases operated on for appendicitis, are really malignant growths   Judging from the microscopic struc-

tunc alone, the conclusion that the tumours are spheroidal celled carcinomas is difficult to resist, and the view expressed by some pathologists that the structure is that of an endothelioma does not seem satisfactory

If Krompecher's view is correct, these strange little tumours of the appendix and small intestine belong to the group of 'carcinoids'—tumours having the histological but not the other features of a small spheroidal-celled carcinoma. This may not seem altogether satisfactory, but the fact remains that in deciding upon the nature of a tumour it is necessary not only to consider its minute structure, but also to take into account its other features

Oberndorfer, quoted by Krompecher states that the cells of these basal celled tumours contain an abundance of a doubly refracting substance. Probably this is fatty in nature, and the yellow colour of the appendix tumours may be due to it

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VISITS TO SURGICAL CLINICS AT HOME AND ABROAD

THE CLINIC OF SIR BERKELEY MOYNIHAN

LEEDS, itself a great city in the centre of a densely populated district, is in the fortunate position of having a single teaching hospital with which have been associated, for many generations surgeons who have been leaders and teachers. The General Infirmary was the first institution of its kind in this country to be built on the pavilion system, and it occupies a large site in the centre of the town. Here it is that since 1895 when he was appointed assistant surgeon Sir Berkeley Moynihan has done most of his hospital and teaching work. His own personal contributions to the sum of surgical knowledge and tradition have been communicated to a world-wide circle of students by his pen, his addresses, and by his visits to other cities or countries. Surgeons who wish to see his work are welcomed, and given every facility for examining his cases, watching his methods and discussing his ideas.

One of such a group of surgeons the present author, spent a whole day crowded with intellectual delight in the wards, laboratories, and operating theatre with Sir Berkeley, and the following brief narrative is an account of things seen and heard on that occasion.

In the morning we began with a clinical round in one of the male wards. The first case was a man of 55 whose abdomen presented a very large spleen. His face was somewhat flushed. He had had a blood examination by a well-known pathological laboratory before admission, which reported 4,000,000 red and 5000 white cells, and he was sent in as a case of probable splenic anæmia. But further and repeated blood reports showed that he had between 8,000,000 and 9,000,000 red cells, and this proved that the disease was polycythæmia vera. It was pointed out how very easily a serious mistake might have been made if the single blood examination had been relied upon. A removal of the spleen would certainly have been followed by a lethal issue. The splenic hypertrophy was regarded as an attempt to counteract the excessive blood-cell formation taking place in the bone-marrow. For the moment treatment consisted in the application of radium to the femora and tibiæ, in order to lessen cell-production. The possibility of removing bone marrow by direct attack on these bones or by removal of alternate ribs was mentioned.

The second case was one of splenic anæmia occurring in a boy of 12. The liver and spleen were both much enlarged and the patient was being kept under observation with a view to splenectomy. A brief account was given of the history of Banti's disease, and the stages of the disease were described, it being held that in the usual course of events a large liver stage was followed by one with contracted liver. The operative mortality for the operation for this disease was at least 10 per cent, this high figure being accounted for by the dense adhesions which tie the spleen in its place.

The next case was one of a boy recovering after excision of a hydatid cyst of the liver. In this operation in order to obviate the danger of dissemination by the hydatid fluid the cyst was injected with a 4 per cent solution of formalin after aspirating a portion of its contents. The cavity left after enucleation of the cyst had been obliterated by mattress suture so that no drainage was required and the wound healed by first intention.

The fourth case was a man of 31 whose face proclaimed him to be suffering from a severe grade of anæmia He had had a profuse hæmatemesis three months ago, and it was pointed out as characteristic of Banti's disease that the recovery from hæmorrhage was very much slower than from bleeding caused by other conditions such as gastric ulcer The patient had a moderate enlargement of the spleen, over which was strapped a plate of radium In addition to the latter treatment, by which the spleen would be greatly reduced in size, the anæmia was to be treated by step ladder transfusion of blood, the method employed being that of the syringe

We then saw a man, age 57, whose history was typical of a duodenal ulcer We saw this same patient operated upon in the afternoon, when it was found that there was a double ulcer one on the anterior and one on the posterior wall of the duodenum

FIG 172 —In the wards

The next patient was an elderly man suffering from an enlargement of the prostate On his admission this patient had 126 mgrm of urea per 100 c c of blood, indicating great inefficiency of the renal function By rest in bed and irrigation of the bladder this figure had been reduced to 38 mgrm The patient was thus ready for operation, which was to be done that afternoon The work of Dobson in this connection was referred to and Sir Berkeley mentioned that of 400 cases of prostatectomy which he had himself done, he lost from pulmonary embolism 4 out of the first hundred, 3 from the second, 2 from the third, and none from the last hundred this improvement being entirely attributed to more careful preparation He did not, however, hold with the idea of a two stage operation as he considered this could be obviated by irrigation through a catheter

The last case we saw in the wards was a man of middle age from whom an epithelioma had been removed from the side of the tongue by diathermy, the mouth presenting then

a clean granulating ulcer   The next stage of treatment in this case would be to do a Crile's block dissection of the neck, removing the sternomastoid muscle, jugular trunk, and lymphatic vessels in one mass

As we had been seeing several cases of splenic disease, we were taken into a demonstration theatre and shown a series of lantern slides illustrating various conditions of the spleen, together with some diagrams illustrative of its functions and their pathological disturbance in various conditions

We next paid a visit to Sir Berkeley Moynihan s Private Surgical Hospital, which is adjacent to the Infirmary building   It consists of a certain number of ordinary dwelling-houses communicating with one another, with the special adaptation of suitable rooms to form two operating theatres, sterilizing room, and pathological laboratory   In the operating theatre, immediately after each case has been completed, Sir Berkeley makes a diagrammatic drawing of the conditions found and of the operation done and these drawings in coloured chalks give at a glance the salient facts of each case

We saw and examined a few of the cases in the Home at varying stages of their convalescence   One was an elderly gentleman from whom about half the tongue had been removed by diathermy, and who was awaiting the operation for the removal of the glands of the neck   It was pointed out that although the application of diathermy caused a large open sore, yet the condition was one associated with very little pain, the electrical application having apparently the effect of a deep anæsthesia   Another patient was a lady from whom a number of stones had been removed from the common bile-duct   At the time of operation she had been very deeply jaundiced   After the stones had been removed, a large rubber tube with an internal diameter of one inch had been tied into the duct   Through this tube daily irrigation had been done so as to remove any debris which might cause recurrence of a stone   We saw several other patients recovering from gall-bladder operations, and were told that nearly a quarter of the operations done for this condition are secondary ones for patients who have already been the subject of various other operative procedures

In the pathological laboratory we met Dr Gruner, who has charge of this department Amongst other objects of interest we were shown various batches of cockroaches which were kept under observation in relation to a nematoid worm which inhabits their cæcum and which is supposed to be a carrier of a parasite which induces carcinoma of the stomach in rats

In the afternoon we returned to the General Infirmary and saw a series of four abdominal operations performed by Sir Berkeley

The first was a gastrectomy for gastric ulcer   The patient was a woman of 50 with a ten-years' history of dyspepsia and hæmatemesis   The diagnosis of gastric ulcer had been made by means of the x rays, which showed a half-inch crater on the lesser curvature of the stomach, rather nearer to the cardiac than the pyloric orifice   The abdomen which had been prepared by picric acid spirit, was washed with ether soap, biniodide of mercury in spirit (1–500), and finally swabbed with Harrington solution, and opened by an incision through the right rectus sheath, the muscle being displaced outwards   About twelve small bleeding points were picked up with artery forceps and tied with fine catgut After the peritoneal cavity had been opened, the subperitoneal tissue was injected with a solution of quinine and urea at about three separate points on each side of the incision The stomach was drawn out of the abdomen, together with part of the transverse colon, and the presence and situation of the ulcer were confirmed   All exposed viscera were covered by rubber and gauze pads—that is, rubber sheeting covered with gauze   Some strong adhesions between the ulcer and the abdominal wall were divided and ligatured A hole was made in the mesocolon, and a long gauze swab pushed through this into the lesser sac of the peritoneum   The duodenum was packed off, the vessels of the upper and lower margin were tied in two places and divided, and the duodenum was clamped by forceps and divided, the cut edges being swabbed with pure carbolic acid   The distal end of the duodenum was closed by a continuous running stitch of thread, which was tied after removal of the forceps   The great omentum was tied off below the greater

curvature of the stomach in seven pieces, and the lesser omentum in three portions
The stomach was then pulled downwards and over to the left making the coronary
artery prominent so that this was easily divided between two ligatures A long pair of
rubber covered clamps was then passed across the stomach proximal to the ulcer The
colon was now turned upwards and the upper portion of the jejunum exposed and divided
four inches below its origin, this division was done in the same way as in the case of the
duodenum, and the distal end was closed by a running suture This closed end of the
jejunum was drawn up into the lesser peritoneal sac after removing the gauze swab, and
was apposed to the posterior surface of the stomach below the stomach clamp The
jejunum was then joined to the stomach by four rows of fine catgut stitches thus forming
an end to side anastomosis The distal portion of the stomach containing the ulcer being

FIG 4 — In the operating theatre

removed the region of anastomosis was drawn down to the opening in the mesocolon
and fixed there by catgut stitches The proximal end of the jejunum was now implanted
into the left lateral margin of the descending loop of jejunum and the continuity of the
canal thus restored The operation lasted an hour and a quarter apart from the closure
of the abdomen which was undertaken by the assistant It may be added to the above
description that what sounds so complicated to describe appeared to be very simple and
easy in execution Further evidence was afforded as to the innocuous character of the
operation by the smooth recovery of the patient about whom special inquiry was made
a week later She had a perfectly quiet convalescence such as might have been experi-
enced by the simplest case of gastro enterostomy

Whilst the first case was being finished and preparations were being made for the
next we spent a quarter of an hour in an adjoining demonstration room, where we

saw a large number of specimens and water-colour drawings of gastric ulcer which had been removed by gastrectomy. A demonstration was given of x ray pictures showing the diagnosis of gastric ulcer. Great emphasis was laid on the impossibility of making a correct diagnosis by any other means. It was claimed that by the x rays this can be made in 96 per cent of all cases. In the typical case a barium meal and x ray reveal ' a niche and a notch' the former is caused by the excavation of the ulcer and is seen on the lesser curvature, the latter by a spasmodic contraction indenting the margin of the great curvature.

We then returned to a second operating theatre, where a gastro-enterostomy was done for a case of duodenal ulcer whose symptoms had been described to us in the ward in the morning. It was pointed out how much more frequent is the occurrence of duodenal than of gastric ulcers, and how much more certain the diagnosis and simpler the treatment. The operation was performed on the lines which Sir Berkeley's teaching has made classical. The anæsthetic in this and in all other cases that we watched was mainly by gas and oxygen, with occasional administrations of ether, it being rare for more than two ounces of ether to be given for the longest case. After the patient's abdomen has been prepared and the anæsthetist screened off by a wire frame, the whole table is covered with a green sheet with a central slit. The green colour serves to rest the eyes during a long course of operating. A special shelf on which to place instruments that are being used during the course of the operation is placed over the patient's feet and covered with the green sheet. On one side of this is a square of scarlet cloth on which are placed all instruments the sterility of which has been endangered, as, for example, the knife or scissors used to open the intestine. Throughout the entire operation the only suture or ligature material used consisted of the finest iodized catgut. The size of this was said to be represented by six noughts. The abdomen was opened by a right-sided incision, through both sheaths of the rectus, the muscle being drawn to one side. Every smallest bleeding point in the parietes was closed by ligature. The duodenum clearly showed the external scarring and puckering of an ulcer on its anterior wall, and a second ulcer could be felt in the deep wall. In doing the actual anastomosis, large rubber covered clamps were used, a free removal of mucous membrane was made from each viscus before inserting the inner stitch, and in doing the latter the mucous membrane was rather everted, so as the better to control hæmorrhage. The operation occupied thirty-five minutes, but a considerable portion of this time was occupied in demonstrating various points of the technique.

The third case operated upon was that of a woman of 50 who for eleven years had suffered from an indefinite type of dyspepsia. X rays showed nothing but a rather large and dilated stomach. The operation revealed a normal gall-bladder, and a stomach the pyloric portion of which was congested and irritable, readily contracting on being touched. The appendix was long, kinked and adherent. The case was regarded as typical of appendix dyspepsia and the offending organ was removed.

Whilst waiting for the next operation we again adjourned to the demonstration room and were shown a number of specimens illustrating the first cases of prostatectomy done by McGill in 1887 and onwards. These consisted of three series, the first being small bits punched out from a projecting prostate, the second one or more lobes of the organ and the third the entire gland enucleated from the bladder, the first complete specimen of the kind dating back to 1890.

We then returned to the operating theatre and watched a prostatectomy done on the patient whom we had seen earlier in the day. The operator stood on the patient's right side using his left hand for the bladder manipulation, his right hand being in the rectum. After the abdominal wall had been incised and the bladder exposed, a receptacle like a basin without a bottom was placed over the incision. This receptacle had a rubber ring round its lower margin and a large drainage tube attached to its side. This had the effect of carrying away all the fluid which escaped on opening the bladder.

Sir Berkeley Moynihan on another occasion had before him a boy some 19 years of age with hæmolytic jaundice and an enlarged spleen. A long incision was made over

the upper part of the left rectus abdominis, the sheath opened, and the muscle displaced laterally On opening the abdomen the large spleen was displayed, and delivered after a few diaphragmatic adhesions had been divided It was pointed out that these adhesions are rare in hæmolytic jaundice but more common in splenic anæmia They are indeed the chief cause of the operation mortality attending splenectomy in the latter condition On delivery, the spleen was wrapped at once in large rubber and gauze packs The abdominal wall was raised and a large moist swab placed in the splenic bed, a step which the operator considers of great importance The splenic pedicle was now dealt with bit by bit, No 3 catgut ligatures being carried through on a large blunt ligature needle The operator reminded the students of the danger of including the tail of the pancreas in tying off the pedicle, describing such a happening as of less importance to the patient than to the surgeon, a technical blemish rather than a disastrous mistake Whilst this little homily was in progress Sir Berkeley discovered that he was on the point of including some couple of inches of a very thin pancreatic tail in a ligature Appearances were most deceptive, as the pancreas seemed to end well internal to the line of ligature However, a tail very like the short tail of a dog proceeded from the deeper part of the apparent end of the pancreas, and might easily have been cut away The splenic artery was then identified and divided between ligatures The artery in this case appeared to be normal, having none of that fragility which makes its ligature in splenic anæmia so delicate a piece of work Great care was taken at this stage that no tension should be put on the large splenic vein, which was tied firmly but without undue force The spleen was now free and was removed A small accessory spleen about the size of a tennis ball, and having the same colour and consistence as the main organ, was found and removed lest it should undergo compensatory hypertrophy and cause recurrence of the jaundice The last stage of the operation consisted in a careful revision of the splenic bed, whence the large pack was withdrawn, and one or two small oozing points were caught and tied *

The next case was one of gall-stones in a woman A paracostal incision was made, the external oblique divided in the direction of the skin cut, and the fibres of the deeper muscles split horizontally This gives admirable exposure and leaves a firm scar The intercostal nerves displayed were carefully preserved Sir Berkeley remarked that this incision had taught him the exact site of the lower intercostal nerves, knowledge which he turned to good account in placing his quinine urea solution when using vertical incisions near the mid-line The gall-bladder was gently drawn out after packs had been placed in the kidney pouch and to the left, shutting off with thoroughness the general peritoneal cavity Previous palpation revealed stones in the gall-bladder, none in the ducts Sir Berkeley drew attention to deposits of fat about the vessels He remarked that this together with the fat beneath the serosa, denoted infection in the wall of the viscus, as the observations of Dr Gruner and himself had established The appearance is characteristic and of considerable importance The neck of the gall bladder was displayed and the special cystic-duct forceps applied after it had been gently pushed through the pedicle to isolate this duct The cystic artery was taken separately, and a moment later a small accessory artery seized before division The gall-bladder was now removed with a few touches of the knife from below upwards, and a pack placed in its bed Attention was then directed to the appendix Sir Berkeley remarked that it was his invariable rule to remove the appendix in all cases of gall-bladder disease, and that frequently appendicectomy was the first step in the operation of cholecystectomy As to the drainage of the abdomen after a clean cholecystectomy, Sir Berkeley said that whilst drainage marred perhaps the cosmetic perfection of the operation, he believed that with drainage walked safety and for that reason he preferred to leave an exit A rather large rubber drain cut very obliquely was accordingly placed against the gall-bladder bed down to the ligatured stump of the cystic duct

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*The two cases of splenectomy mentioned in this article have made good recoveries The jaundice in the second case had completely disappeared in ten days time

No account of the clinical and operative work of Sir Berkeley Moynihan would be complete without some description of the atmosphere or spirit in which the whole work is done. Keen enthusiasm and endless pains in the perfection of detail are perhaps its leading characteristics. It is impossible for the most indifferent onlooker to avoid being infected with some of this enthusiasm. Surgery becomes more than an art or a craft. It is a religion.

A most impressive thing is the scrupulous attention paid to small details. The ligaturing off of every vessel before the peritoneum is opened is an example of this. Everything is calm and unhurried, everything looks easy, and above all, everything looks safe. As a dresser was once overheard to remark. " When *we* go into the abdomen we take no risks ! " The risks are not avoided by the shirking of difficulties, but by the infinite pains that are taken to eliminate causes of failure. To-day we see a machine running with the greatest smoothness and precision. The man who designed it is an artist.

LIGATION OF THE INNOMINATE ARTERY FOR INNOMINATE ANEURYSM

By SIR CHARLES BALLANCE

ALL the cases recorded in the following paper, except my own, are of ligature of the innominate for subclavian or carotid aneurysm   The point I wish to emphasize is that there are cases of innominate aneurysm which are suitable for proximal ligature, and that these can be diagnosed with the means at present at our disposal   (*Figs* 434, 435)

Case 1 —E T , female   age 60, married, five children admitted St Thomas's Hospital, December, 1918   She was a small, thin pale woman who had had syphilis   The left tibia was deformed from osteitis and periostitis, and the pupils were irregular and fixed in consequence of old iritis

Fig 434   Aneurysm (6½ × 3 in) of bifurcation of innominate artery with healthy artery below   A piece of sternum projects from the aneurysm (Museum R C S Specimen No °217)

Fig 435 — Aneurysm of innominate artery with no possibility of proximal ligature (Museum R C S   Specimen No   219)

There was a pulsating tumour on the right side of the lower part of the neck   It appeared above the inner extremity of the right clavicle and above the upper edge of the manubrium and could be seen and felt beyond the median line   Below, the tumour extended into the superior mediastinum   it seemed to be about the size of an orange   The pulsation was expansile   The radiogram did not show any deformity of the arch of the aorta or heart   the aneurysmal tumour and pulsation appeared to be limited to the upper part of the innominate artery, for it did not reach so low as the arch of the aorta   The condition of the right pupil did not allow of observation as to the involvement of the sympathetic   The pulses in the right arm, and the pulses in the right carotid and right temporal arteries were markedly weaker than the corresponding pulses on the left side   The urine was normal

The common site of aneurysm of the innominate artery is at the bifurcation of the vessel, the distal half of the artery being affected while the proximal part of the artery is often not dilated,

or only slightly so It was determined, therefore to explore the superior mediastinum and if possible, to ligate the artery proximal to the aneurysm

OPERATION Dec 31, 1918 — A vertical skin incision was made in the median line and another transverse one on a level with the upper border of the manubrium   The flaps were dissected up so as to give a wide superficial exposure The wall of the aneurysm was very thin, so it was desirable to keep as far as possible away from it

The approach to the proximal part of the artery was planned from above and from the left downwards and towards the right The sternomastoid origins from the sternum and left clavicle were detached, as were also the sternohyoid and sternothyroid origins from the manubrium The inner extremity of the left clavicle internal to the costoclavicular ligament was taken away Then the cartilage of the left 1st rib was cut through close to the manubrium The left 1st rib and the left clavicle were held firmly together by the costoclavicular ligament

FIG 434 —*Case 1* Showing portions of manubrium and clavicle removed

The manubrium was sawn across opposite the lower border of the 1st rib to a point corresponding to a vertical line dropped from the inner extremity of the right clavicle The left upper portion of the manubrium was then removed after dividing the bone in the above vertical line (Fig 436)

The sections of bone were made with the fingers inveigled behind the clavicle and sternum so as to prevent damage to the parts beneath The operation was then continued, the edges of the pleura being pressed away by wet gauze manipulation It was at once clear that the aneurysm did not extend down as far as the arch of the aorta The dissection of a little fibro fatty tissue exposed the left innominate vein and the upper border of the arch of the aorta

It was then not very difficult to expose the unexpanded portion of the innominate artery below the aneurysm

No haemorrhage occurred The innominate artery was ligated with kangaroo tendon, two strands being used ; these were tied with a stay-knot without rupture of the coats Pulsation of the aneurysm ceased at once, and the wound was closed in the usual way

FIG 435 —*Case 1* Proximal ligation of innominate artery for aneurysm of the bifurcation completely cured A Scheme of method of ligation
(*Both Case 1 Cases specimens not numbered*)

The wound healed by first intention The right arm was useless at first It lacked warmth, pain was complained of in it, no pulse could be felt in any of the arteries, and the fingers could be moved only slightly There was obviously a lack of blood going to the muscles and nerves There was a slight improvement at the end of six weeks, but no pulse was present The aneurysm had shrunk in size and remained as a solid tumour

in any artery of the right upper extremity The aneurysm had shrunk in size and remained as a solid tumour

January 1921 Patient was seen again She complained of dyspnoea and palpitation on exertion There was no sign of a pulsating tumour, but a small hard mass could be felt behind

the inner extremity of the right clavicle   An artery was felt crossing the right posterior triangle
of the neck (query, enlarged transversalis colli ?)   The right arm had completely recovered, the
radial pulse at the wrist did not appear to differ from the left radial pulse

May 12, 1921   Patient admitted to St Thomas's   A large amount of albumin and a few
casts were present in the urine   There was ascites and great œdema of the legs, also dyspnœa
and palpitation on the least exertion   The heart was much enlarged, and a loud systolic murmur
was heard   Right arm   systolic blood pressure 150   Left arm   systolic blood pressure 174
The artery previously noted crossing the right posterior triangle of the neck was obvious

June 5, 1921   A severe rigor occurred, with high fever and with pain in the chest, and
death took place the next day
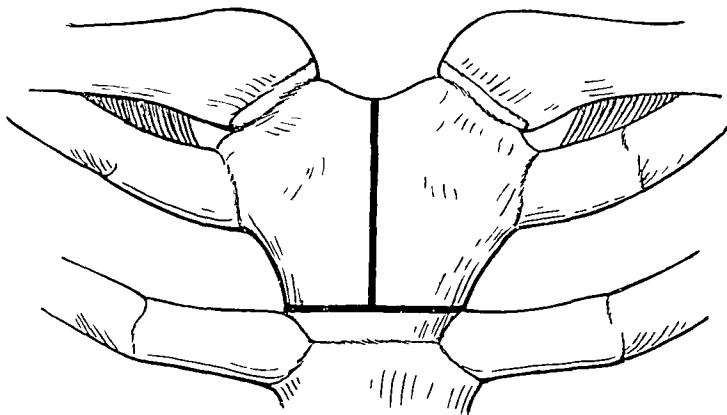
Fig. 458 —*Case 2*   Lines of section of manubrium

At the autopsy the immediate cause of death was found to be a large infarct in the lung   The
large vessels at the root of the neck were dissected out and distended under pressure   They were
subsequently prepared and mounted by Mr Shattock   No enlarged transversalis colli artery was
discovered   The right subclavian, nearly as far as the commencement of the first part of the
artery was patent, and no doubt the circulation in the right arm had been re-established through
the branches of the first part of the artery

The specimen shows the complete success of the operation   The artery is obstructed at the
site of ligature   The aneurysm has disappeared, its remains are shown in the fibrous mass into
which the distal portion of the innominate has been changed (*Fig* 437)
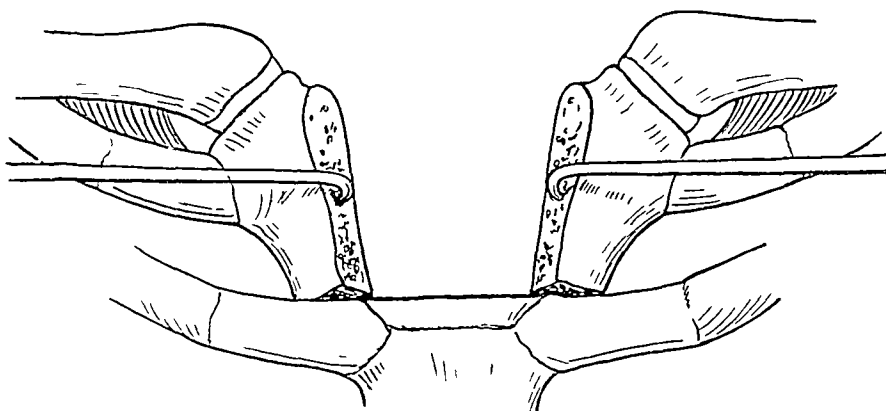
Fig. 459 —*Case 2*   The two halves of the manubrium forcibly separated

Case 2 —In 1902 I published a case of ligation of the innominate artery [1]   The patient was
a Royal Marine aged 35   The aneurysm involved the bifurcation of the artery and extended some
distance above the inner extremity of the clavicle and right side of the manubrium   This patient
underwent a course of Valsalvian treatment before the operation, and I think this was the cause of
the fatal issue of the case

The manubrium was split vertically in the middle line, and divided transversely at the level of the upper border of the 2nd costal cartilages (*Fig* 438) The two halves of the manubrium were pulled apart by hook retractors (*Fig* 439) Below the aneurysm the innominate—of normal size—was exposed Four ligatures of gold-beater's skin were passed around it and tied in two stay knots without rupture of the coats The pulsation of the aneurysm ceased immediately

A few hours later the patient was noticed to have left hemiplegia, and in thirty hours from the operation he died

At the autopsy the aneurysm and great vessels were dissected free of other structures and removed They were distended with cacao butter and placed in formalin for subsequent dissection The right common carotid, the right internal carotid, and the right middle cerebral arteries were found full of clot

Case 3—In 1912 I related in the Clinical Section of the Royal Society of Medicine a case of ligation of the innominate artery for subclavian aneurysm In this case the pulsating swelling extended from the inner extremity of the right clavicle outwards to beyond the mid-point of the bone, and was assumed to involve all three parts of the subclavian artery The carotid and temporal pulses were equal, but the right radial pulse was much feebler than the left The right pupil was contracted The patient was a clerk, age 43

Sedillot s operation was first attempted, but on retracting the adjoining margins of the sterno-hyoid muscle and the internal jugular vein, the thin wall of the aneurysm was exposed, entirely covering over the first part of the subclavian This operation was then abandoned, and a median vertical incision was made as a preliminary to exposure and ligation of the innominate
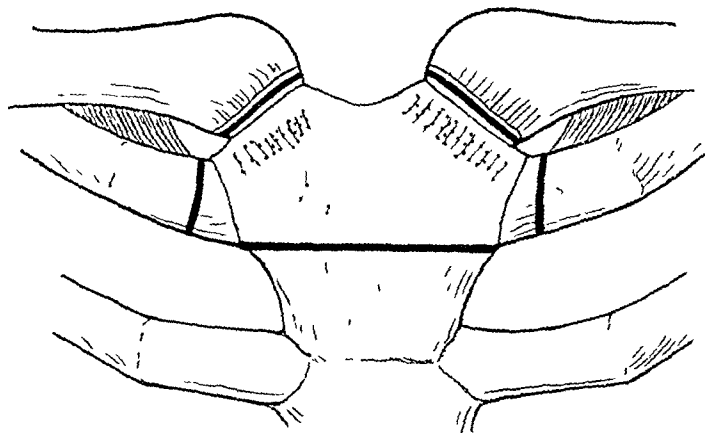
Fig 440—*Case 3* Showing part of manubrium removed

The upper part of the manubrium was removed (*Fig,* 440), and it was then quite easy to pass two kangaroo tendon ligatures around the innominate These were tied in a stay-knot without rupture of the coats Pulsation of the aneurysm ceased at once With the removal of the upper part of the manubrium the aneurysm was seen to cover over the first part of the subclavian to such an extent as to make it impossible to place a ligature around it and besides not half an inch of the first part of the subclavian was found to be unexpanded, so it was considered wiser to ligate the innominate The wound healed by first intention

The patient suffered very little inconvenience in the right arm from the operation No pulse could be felt in any of the arteries but there was no lack of warmth in the limb There was some numbness and tingling of the ring and little fingers and all the fingers were a little stiff on movement For twenty four hours after the operation the right pupil was dilated it then again contracted and remained so while the patient stayed in the hospital The tumour slowly decreased in size Massage of the area was commenced on the twelfth day, and a month after the operation the patient left the hospital

I have not been able to follow the case since

Case 4—In 1909 a man 35 years of age came under my care He had just arrived from the West and complained of a pulsating swelling above the inner extremity of the right clavicle and above the manubrium He had had syphilis seven years before The tumour had been noticed for some months and had been slowly increasing in size

The right radial and right carotid pulses were much smaller than those on the left side (*Figs* 441 442 443) The further examination made me confident that the aneurysm involved the bifurcation of the innominate Its wall was very thin and the patient was ordered complete rest in bed in the hope that some consolidation would take place

Some days later the aneurysm was found to be extending towards the posterior triangle and also to the left beyond the median line

OPERATION —The inner end of the left clavicle was removed

FIG 441 —Case 4   Right carotid and right radial pulse

FIG 442   Case 4   Left carotid pulse

FIG 443 —Case 4   Left radial pulse

The cartilages of the 1st and 2nd ribs were divided and the left three fourths of the manubrium taken away (*Fig 444*)   It was then found that a portion of the artery between the arch of the aorta and the aneurysm was normal in size   This was cleared, and just as the aneurysm needle was about to be passed, the tumour, being slightly pressed by the fingers to the right so as to give a better exposure, ruptured   A flood of blood poured over me   I passed my finger into the aneurysm, and with it plugged the innominate artery   No further bleeding occurred, but it required some *care and trouble* to ligate the artery with the finger within it The ligation was effected with two kangaroo tendons tied in a stay knot without rupture of the coats

The man died thirty hours later and I was unable to obtain the specimen

The diameter of a tube having such a great influence on the tension of its walls explains why aneurysms are so much more common on the aorta and other large vessels than elsewhere , the difference is far more than the mere difference in blood-pressure which does not vary very much in the principal arteries   The tension on the walls of the larger arteries affords yet another argument against rupturing their coats in ligating

With respect to aneurysms, it will be seen what a strain must fall on the walls of those that are fusiform   If the artery be dilated for a certain length to three times its diameter, the strain on the wall will be three times as great   In a sphere containing fluid the tension of the wall is proportional to the diameter of the sphere and to the fluid pressure   but the tension is only half the transverse tension in a cylinder of the same diameter   If an artery of say 10 mm

FIG 444 —Case 4   Showing portions of manubrium and clavicle removed

diameter has on it a spherical aneurysm 40 mm in diameter   and if there is free communication between the two and no clot in either, the tension in the wall of the aneurysm will be double that in the arterial wall   this explains in part the growth of aneurysms   the reason why large aneurysms do not enlarge more rapidly than they do is because they are in great part filled with clot

In many cases, as the result of the disease of which the aneurysm itself is only a part, there is a considerable rise in blood-pressure and this would induce a further rise of tension in the wall of the aneurysm, thus there is no difficulty in understanding the rapid rate at which some aneurysms grow, and the rupture of others

It seems strange that when a great vessel is ligated and the whole pressure of the blood is thrown upon the small collateral vessels, they do not rupture this they appear never to do The explanation seems to be that the tension in their walls, being proportionate to their diameter, is too small to do harm

In the early days of steam power the makers of boilers did not design them proportionately strong for their diameters—they not unnaturally only took into consideration the steam pressure with which they were intended to be used—the larger boilers, therefore, were prone to burst

The specimen of an aneurysm of the innominate artery in St Bartholomew's Hospital Museum (1507) is typical of what I may call *surgical aneurysm of the innominate* The aneurysm involves the bifurcation of the artery, and the proximal portion of the artery is unexpanded and could have been ligated In this case the patient was a girl, age 20, and she died from dyspnœa resulting from pressure on the trachea She was under the care of Sir William Lawrence in 1815 The trachea is apt in these cases to be displaced to the left, a fact that is easily recognized on radiographic examination

It goes without saying that a clear appreciation of the anatomy of the region is of the first importance in the performance of the operation ' I always determine in my own mind ', said the sculptor Chantrey, ' the expression to be given, and unless I can see the face distinctly and with that expression when I close my eyes I can do nothing

From the anatomical point of view, the ligation of the innominate is a cervical operation by no means difficult of performance There is no risk of injury to the pleura if the artery is approached from the front and from the tracheal site, and if the knife is not used outside the limits of the pulsation area But from the pathological and operation standpoints I have found that it is necessary and desirable to remove bone, so as to obtain a clear and free exposure This will be well understood by all those who have had to deal with aneurysms at the root of the neck Each case requires a different plan of operation and the different sections of bone illustrated in this paper show how the varying circumstances of each case were met by diverse and suitable means As soon as the left innominate vein and upper border of the arch of the aorta are defined, the rest of the operation is not difficult Whatever bone removal is decided upon, it can be safely accomplished with the fingers of the left hand inveigled into the superior mediastinum so as to protect the structures therein from injury When the bone has been removed, the edge of the pleura can be pushed on one side by stroking with wet gauze

There is a specimen in the Guy's Hospital Museum (1501⁶) which shows a large aortic aneurysm which had completely obliterated the lumina of the innominate and left carotid arteries by outside pressure The patient lived for a year without a carotid or right radial pulse There are other cases in literature in which the innominate has been closed by endarteritis obliterans The method of closure which I have adopted is to employ two or more strands of kangaroo tendon or of gold-beater's skin ligature and to tie the ligatures by means of a stay-knot without rupture of the coats The force necessary under these circumstances to occlude the innominate is about 3 lb, whereas the force necessary to rupture is about 10 lb so that no difficulty need be experienced in the ligation of the innominate without rupturing its coats

The question of disease of an artery in the neighbourhood of an aneurysm was settled by John Hunter He showed that the artery was not diseased above the aneurysm at least not to the extent that a ligature could not be put upon it I should have no hesitation in ligating an artery close to an aneurysm with a stay-knot without rupture of the coats In so doing the surgeon is only following Nature's method when she by some pathological process occludes a great artery

I cannot say that the ligature of the innominate artery in the cases I have described

is a very difficult operation, but I cannot quite adopt the "gay comparison'* of the late Sir W Mitchell Banks who, in contrasting the ligation of the innominate with ligation of the first part of the subclavian artery, says that it was "a mere surgical† amusement' In a soldier, in 1918, I tied the first part of the left subclavian artery for a traumatic aneurysm caused by a bullet-wound of the artery This was a most difficult operation—certainly far more difficult than any operation I have done on the innominate artery

Up to the year 1902, when I published a case of ligation of the innominate artery there had been 33 cases of ligation of the innominate, 6 of these cases recovered, at any rate for a time In one of them it seems doubtful whether the innominate was tied, and the patient died on the sixty-seventh day The operation in all the 6 cases was done for subclavian aneurysm

Thomson, in 1915,[2] collected 52 cases of ligation of the innominate for subclavian aneurysm There were 16 recoveries (30 7 per cent) The operations performed were for —

	CASES	RECOVERIES
Spontaneous aneurysm	41	12
Traumatic ,,	6	2
Wounds of great vessels	5	2
Totals	52	16

Since 1915, 5 more cases have been published —

1 Ligature of innominate and carotid Death on fourth day from hemiplegia (*Cleveland Med Jour*, 1916)

2 Ligature of innominate and carotid Recovery, but pulsation in the aneurysm reappeared in three weeks (*Surg Gynecol and Obst*, 1917)

3 Ligature of innominate and carotid for traumatic aneurysm of the carotid Recovery (*Brit Med Jour*, 1917)

4 Innominate and carotid ligatured Recovery (*Surg, Gynecol and Obst* 1918)

5 Ligature of innominate Death from haemorrhage on the table As the aluminium band was being passed around the artery, the aneurysm was injured on the distal side of the vessel (*Surg Gynecol and Obst*, 1918)

Conglin of St Louis University, who operated on the last two cases, removed the upper part of the sternum, the lower section corresponding to the level of the 3rd cartilage This gave an admirable exposure and facilitated the subsequent manipulations In all probability surgeons will adopt, in the future, removal of the upper part of the sternum as a preliminary to ligature of the innominate artery for innominate aneurysm

SUMMARY

I desire particularly to lay stress on the following points —

1 That cases about to be submitted to operation should not be previously treated by the method of Valsalva

2 That there is a group of cases of aneurysm of the innominate artery (aneurysm of the bifurcation) which are suitable for proximal ligature Distal ligature causes the aneurysm to become a diverticulum of the aorta, and so increases the pressure within it, and should not be done when proximal ligature is possible

3 That the presence of the aneurysm necessitates removal of a part of the sternum in order to gain a free and clear exposure of the vessel below the aneurysm

4 That the ligation of the innominate may be safely and surely accomplished if the ligatures are tied in a stay-knot without rupturing the coats

REFERENCES
[1]BALLANCE *Lancet* 1902 Nov 1
[2]THOMSON *Ann of Surg*, lxi

THE RADICAL CURE OF INGUINAL HERNIA IN CHILDREN, WITH SPECIAL REFERENCE TO THE EMBRYONIC RESTS FOUND ASSOCIATED WITH THE SACS.*

By ALEX MacLENNAN, Glasgow

SINCE the opening, in August, 1914, of the New Royal Hospital for Sick Children in Glasgow, till the end of 1920, I have personally performed 1038 operations on 978 children for the radical cure of inguinal hernia

OPERATION —A description of the routine operation was published in the *Clinical Journal* for July 22, 1914

AGE —The operation was done in 522 cases ranging from two weeks to one year, in 253 from one to two years, in 75 from two to three years, and in 128 from three to twelve years—the age limit for the hospital   Unless detained for some special reason, children under three years of age were sent home on the day of operation

SEX —The vast majority of hernias occurred in males, the proportion being 910 to 68

SIDE —619 hernias occurred on the right side, 224 were on the left, while in 125 cases both sides were involved

MORTALITY —Eight deaths occurred from half an hour to several weeks after the operation   One infant died shortly after the attempt to cure a recurrence following a Bassini operation, post-mortem examination was refused, but from the behaviour of the child during anæsthesia it was doubtless the subject of the condition known as status lymphaticus, three other fatalities of a similar nature showed at the autopsy an advanced condition of this malady   One child died of marasmus and bronchopneumonia several weeks after operation, the wound being beyond suspicion   In three cases the cause of death was gastro enteritis

MORBIDITY —The bladder was opened accidentally in two cases, the rent was sutured, the bladder was drained by catheter, and the operation area was unaffected The vas deferens was completely torn through on two occasions, it was treated in the manner described in the *Clinical Journal* already referred to

Sepsis of a mild type occurred on four occasions, the radicalness of the cure was not vitiated in any way

Recurrences took place, certainly in four, and possibly in five cases   One was a new hernia through a tear in the conjoined tendon caused by a mattress suture—a procedure not now resorted to unless for very exceptional reasons   The other three were due to breaking of the catgut suture which draws up the sac, a very fine silk (No 000) is now employed

A diminutive undescended testicle was removed in one instance

COMPLICATIONS —The bladder presented with the sac in seven children, including the two cases where it was accidentally opened

Tubercle on the contents of the sac or on the sac itself was present in five cases This contamination did not interfere with healing in any way

Strangulation was present in four cases   all recovered   One was a strangulation of the cæcum and appendix the latter being removed

The appendix was removed on fifteen occasions, the after-treatment of the children was not altered in any way   nor was the incision enlarged or the canal laid open   all recovered

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Instances of sliding hernia were found in five children   this being exclusive of the hernias down the canal of Nuck   In one of these cases a well-marked Jackson's membrane was present   while in another a Lane's 'kink   was divided

On two occasions the ureter appeared on the under surface of the neck of the sac

FIG 145 —Showing cortical structure of the common adrenal rest   (× 24)
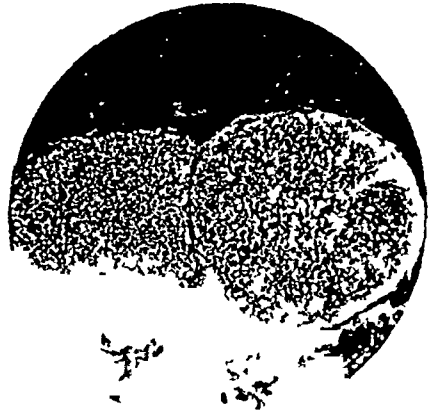
FIG 146 —Less common bilobed adrenal rest   (> 24)

Frequently the obliterated hypogastric artery was observed coming into the wound as the sac was drawn out

DIRECT HERNIAS —Though denied by many surgeons ever to be present   sacs with the deep epigastric vessels on their outer sides were observed possibly on four occasions
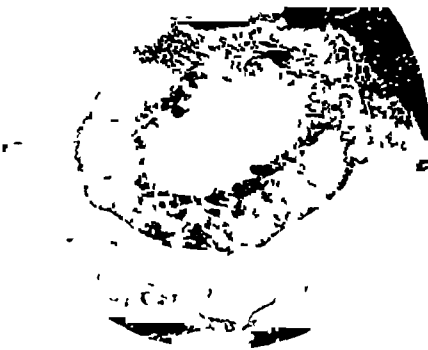
FIG 147 —Adrenal rest   showing advanced calcareous degeneration   (24)

FIG 148 — Composite rest adrenal cortical tissue with tubule in section lined by ciliated columnar epithelium   (24)

and certainly on three   in one case two sacs were demonstrated, one on each side of the epigastric

VESTIGIAL RESTS —In eighteen cases 19 bodies were examined with a positive result   one child had an adrenal body on each sac of a bilateral hernia   In 14 of these

cases the tissue was cortical adrenal—first described by me in *Surgery Gynecology and Obstetrics* (six cases) October 1919 Since then a more careful scrutiny of the parts during operation has shown that they occur very frequently Varieties of the type already described have been found These are illustrated in *Figs* 445–447 The more
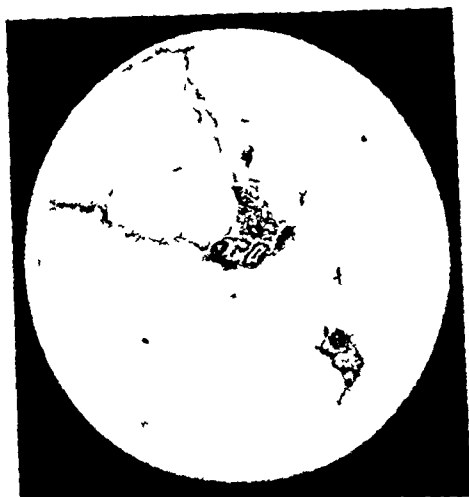
Fig 449 —Small rest composed of tubules lined by columnar epithelium (24)

Fig 450 —Section of cysts and tubules in larger rest lined by cubical epithelium Macroscopically appeared as a small encysted hydrocele of the cord (30)

usual adrenal rest closely resembles a tomato seed it adheres to the outer surface of the sac between the vessels of the cord and the vas The bilobed nodule (*Fig* 446) has been unusual *Fig* 448 shows an adrenal body associated with glandular tissue Probably *Fig* 447 indicates the ultimate fate of these accessory adrenals—calcareous degeneration
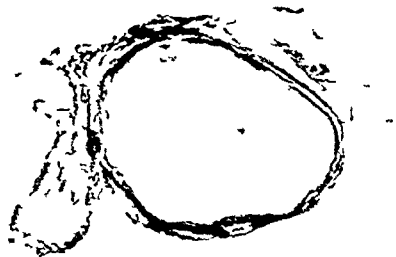
Fig 451 —Section of small nodule lined by squamous epithelium (24)

Fig 452 —Section of compound rest epidermoid in association with tubules on two sides (24)

In a few cases I have omitted to remove an apparent adrenal rest, while in one instance a rest was transplanted under the edge of the wound without detriment So far these rests have only been found in males the age varied from two weeks to eight years

It is a well-known occurrence to find adrenal accessory glands far removed from their usual site Such accessory nodules are seldom composed of or contain medullary substance, the cortical structure being alone represented The exact embryological origin of these structures is still a matter of discussion, but in all the examples now under review the close association with the hernial sac was a uniform feature , their origin by detachment from the main adrenal capsule during the development of the processus vaginalis is there fore a legitimate deduction In this connection they substantiate the saccular theory of hernia as applicable to the so-called acquired sac, and at the same time they answer two criticisms of the technique of the operation carried out at the hospital, namely, that the incision is too small to allow of adequate inspection of the parts, and that the opera tion is performed too hastily to allow of proper observation of the conditions present in baby hernias

Fig 449 illustrates a small nodule composed entirely of tubules resembling, as was pointed out to me by Dr Haswell Wilson (pathologist to the hospital) epididymis tubules These tubules are lined by columnar epithelium, possibly ciliated The same structure is shown, at least so far as the columnar epithelium lining is concerned, in *Figs* 448 and 450 In all probability, therefore, these rests arise in the Wolffian tubules The appearance to the naked eye of the vestige whose section is depicted in *Fig* 450 was that of a minute encysted hydrocele of the cord

Fig 451 shows a different type of rest Two of these bodies have been discovered one in a male and one in a female Both appeared as minute just visible, pearly bodies, having a hard cartilaginous consistence Both were attached to the neck of their respec tive sacs They are cysts lined by squamous epithelium the contents being structureless epithelial debris

Fig 452 illustrates the structure of a rather more complex type, more recently acquired from a hernial sac in a male a case not included in the series The main mass of the little relic shows the same structure as that of *Fig* 451, but on both sides are seen sections of tubules similar to those seen in *Figs* 448 and 450 This specimen at least indicates that the epidermoid and the Wolffian tubules arise from the same place It has been suggested that the Wolffian duct arises from the epiblast and possibly this association of Wolffian tubules with an epidermoid may lend support to this view

Professor Bryce, to whom I showed the figures, is of opinion that the adrenal bodies are accessory adrenals, and that the other glandular rests are related to the Wolffian tubules, while the squamous epithelium-lined sacs must be explained by the close relation ship of the various body layers at an early date in the development of the ovum

RESTORATION OF THE NOSE BY TRANSPLANTATION OF SKIN FROM THE FOREHEAD IN THE YEAR 1881

By T PRIDGIN TEALE Leeds

W H , in 1876, when at the age of 18, was kicked in the cheek whilst tending a horse This led to the destruction of the fleshy and bony part of the nose, leaving a large hole in the centre of the face He became a patient of the Huddersfield Infirmary where various measures were tried under the care of the late Mr Kilner Clarke

On Jan 28, 1878, he came into the Leeds General Infirmary for three months and then became an out-patient until 1881 In May of that year the new nose was made by Mr Pridgin Teale, and nine days afterwards the stitches were removed Within three weeks the raw gap on the forehead was healed over

Fig 4? — The patient (W H) at the date of the operation in 1881

In a recent letter to Mr Teale (1921) Mr H expresses his feelings as follows —

" Since the operation I have been able to take my place amongst the world of men, earn my living, and to follow the occupation of a plate-layer on the railway, having been rescued from being merely an outcast and a pariah, pointed at, derided, and scorned by the thoughtless and the ignorant '

Figs 44 45 W H forty years later in 1921

There is one lesson which I would enforce by this case About the time of this operation it was taught by some surgeons that is soon as the flap was safely grown into place the pedicle should be severed I taught that to do this was to risk subsequent shrinking of the new nose This teaching was enforced in my address at Nottingham on ' Atrophy induced by Cicatrix, and its Surgical Value This view was sound, but it must be modified in view of the experience of Thiersch s grafts, and transplantation of thin shavings of skin

THE GASTRIC CRISES OF TABES DORSALIS AND THEIR SURGICAL TREATMENT

By R C SHAWE, Manchester

A knowledge of the nervous pathways which are concerned in the production of gastric crises is essential for the efficient surgical treatment of this condition   The first object of this paper is to describe an effort which has been made to determine the nerves through which the various phenomena are produced, and the second object to discuss the results and appropriateness of the several surgical procedures which have been suggested for the treatment of gastric crises

THE NERVOUS PATHWAYS CONCERNED

Considerable information regarding these pathways has been derived from careful investigations of patients who have been operated upon for this condition by Sir William Thorburn, and my best thanks are due to him for permitting me to make use of his cases Prior to discussing this information it will be most convenient to give a brief record of three of these patients treated by rhizotomy

Case 1 —G W M , male, age 47, stationer   This patient, previous to his operation, suffered from a weekly recurrence of the crises   The pain and vomiting often continued for thirty six hours, although of these two symptoms the pain was by far the most severe   A careful consideration of the history of the subjective symptoms showed that the pain consisted of two types (1) A radiating cutaneous pain, commencing between the left scapula and the spine, passing over the left 7th, 8th, and 9th intercostal spaces and across the epigastrium , and (2) A deep griping pain localized to the left epigastrium   Occasionally the crises were accompanied by lightning pains in the limbs
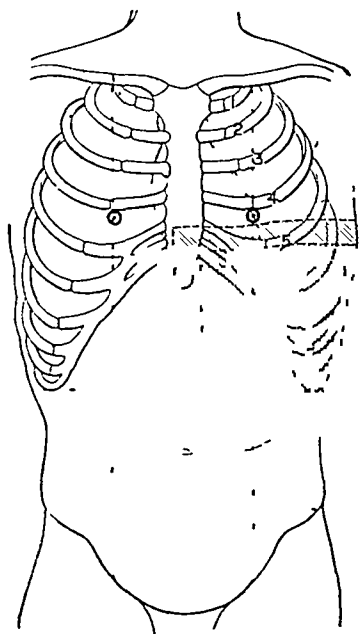
On March 9, 1914, posterior rhizotomy of the left 4th 5th, 6th, 7th, and 8th roots was performed   On examining the patient on Dec 21, 1920, he gave a history of having suffered from only three attacks of vomiting, which had occurred within the first two years after the operation   The above mentioned two types of pain entirely disappeared after the operation, only occasionally he experienced a dull constricting pain across the upper part of the anæsthetic area (*Fig* 456)   There was paralysis, accompanied by marked wasting, of the intercostal muscles in the 6th, 7th, and 8th spaces on the left side

Case 2 —A B , male, age 44, labourer   Prior to operation the crises were experienced daily, profuse vomiting was accompanied by two types of pain   (1) A superficial radiating pain over an area extending from the level of the nipple to the umbilical plane on both sides of the body, and most intense along the distribution of the 8th dorsal nerve , (2) A deep griping pain localized to the epigastrium

On June 1, 1915, bilateral rhizotomy of the 5th to 8th posterior dorsal nerve roots was performed   Following operation the crises recurred about six weeks after discharge from hospital and since then have been experienced at intervals of three weeks   Vomiting has been considerably alleviated, and the radiating pain has disappeared though there is still some deep griping epigastric pain accompanying the vomiting   Besides these symptoms, a dull constricting pain is experienced

across the epigastric area of anæsthesia, which occurs independently of the crises   It is of interest to note that over the entire area of cutaneous anæsthesia (*Fig* 457) the tissues are sensitive to pressure

Case 3—S A W , age 56, housewife Previous to operation the patient suffered from the crises several times a week Vomiting was a pronounced symptom, and was accompanied by excruciating pain localized to the left epigastrium, together with marked tenderness to pressure over the same region

On Nov 8, 1920, unilateral rhizotomy of the 5th to 9th left posterior dorsal nerve roots was performed Immediately after operation pain was complained of in the distribution of the 11th and 12th dorsal nerves on the left side, presumably due to traumatic irritation (*see Fig* 458), because it subsided shortly after operation

The area of cutaneous anæsthesia will be noticed by referring to the sensory charts It will be seen that there was a relatively large area of epicritic loss as compared with the area of protopathic anæsthesia In order to explain these findings, a series of tabes patients, all of whom were under medical treatment, were examined with a view to determining whether they suffered from sensory changes over the skin of the abdomen As a result of these examinations it was found that the majority suffered from slight diminution of tactile sensibility, more especially near the mid-line One case was analgesic over a considerable area of the trunk, another manifested hyperalgesia

The above findings would suggest slight compression of sensory nerve-fibres in the dorsal roots, and such changes would account for the extensive epicritic loss in *Case 3* Over the entire area of cutaneous anæsthesia sensibility of the deep tissues was retained

FIG 457 —*Case 2* The light shade shows the epicritic, and the dark shade the protopathic areas of anæsthesia The central portion indicates the area of dull constricting pain

Five weeks after operation this patient experienced a typical crisis, vomiting and pain being equally prominent symptoms Although the crisis subsided after forty-eight hours, nausea persisted in a varying degree for several days Since then relapses have occurred at intervals of two or three weeks

From the analysis of the preceding cases it is evident that there are two types of phenomena to be considered in a crisis (I) *Sensory* (subjective pain and objective sensory disturbances) , (II) *Motor* (vomiting)

I SENSORY PHENOMENA

From the description given by patients, the pain appears to be of a composite nature and it is not difficult to recognize two distinct forms, one or other of which commonly predominates and somewhat obscures the other The first form, which may be termed somatic, is felt superficially in the body wall, and consists of two types, the one sudden and shooting in character experienced and accurately localized along the dorsal nerves , the other a dull constricting sensation which is not well localized

Cases 1 and 2 suffered from the first type, and were relieved by section of the posterior nerve-roots which strongly suggests that it was caused by irritation of fibres which traversed these roots on their course to the spinal cord

The second type, consisting of a dull constricting sensation, does not appear to be relieved by posterior rhizotomy *Case* 2 furnishes an example of the absence of relief after section of the posterior roots, which seems to indicate that this type of pain is transmitted by some other nervous path, and the three cases recorded here seem to offer some explanation It was noticed that in both *Case* 2 and *Case* 3 deep pressure was readily appreciated over the entire area of cutaneous anæsthesia, the tissues of the lax abdominal wall being easily pinched without any disturbance of abdominal viscera, which clearly demonstrated the sensibility of the deep tissues of the abdominal parietes In both patients the point of stimulation could be localized to within half an inch of the actual point where pressure was applied, and it was also noticed that the muscle tissues were far more sensitive to pressure than the periosteum of the ribs

The association of these subjective and objective sensory phenomena after section of the posterior roots rather suggests that the nervous channels upon which they depend is a common one Hitherto it has been generally supposed that all afferent sensory impulses from somatic areas enter the spinal cord by means of the posterior roots Kidd held the opinion that some of the afferent sensory fibres traversed the anterior roots, and the above results would seem to lend support to such a view The only pathways available for the transmission of these impulses to the central nervous system would appear to be either the anterior nerve roots or the sympathetic system It was readily shown that the sympathetic was functioning in the anæsthetic area, first by the hypodermic injection of pilocarpine nitrate $\frac{1}{10}$ gr , which was followed by general diaphoresis (including the anæsthetic area), and secondly by the local application of cold, which induced pilo motor contractions, even over the area under consideration These experiments invariably proved that the sympathetic was functioning, and had to be borne in mind as a possible path of conduction , but examination of *Case* 1 yielded more definite and positive evidence on the point at issue This patient, unlike the other two, was unable to recognize pressure over the intercostal spaces within the anæsthetic area and this was accompanied by marked wasting of the corresponding intercostal muscles This wasting was noticed shortly after the operation, and appears to be definite evidence of loss of conduction in the anterior roots The loss of deep sensibility in the one patient where there is loss of conduction in the anterior as well as the posterior roots appears to be important evidence in support of the view that this form of sensibility is mediated by afferent fibres which enter the cord in the dorsal region via the anterior roots It is of importance, and further support to the view to notice that *Case* 1 was the only patient of the three who did not suffer from either type of pain after rhizotomy This view is strongly upheld by the results of the operation of posterior rhizotomy in the cervical region, two cases of which are reported by Head In both cases the 5th, 6th, and 7th roots were amongst those divided, and in both cases deep sensibility was completely retained Similarly in a case of cervical rhizotomy performed by Sir William Thorburn, deep sensibility was retained

The second form of pain occurring in a crisis is located to the epigastric region, commonly to the left epigastrium, and will be termed visceral This form of pain is that most prominent at the time of the crisis , in character it is severe and griping, and is commonly accompanied by a deep tenderness which is strictly localized to the left epigastrium In neither case does the pain or tenderness transgress the costal margin In *Case* 3 the continued application of firm pressure with the hand over the stomach resulted in the production of pain localized primarily to the epigastrium, but later spreading diffusely over the upper half of the abdomen, more particularly on the left side The effect was only produced on the deepest pressure Prior to the onset of this phenomenon the pressure on the deep muscle tissues was felt but easily differentiated from the sensations under consideration In the case of this patient it was noticed that when the stomach was completely at rest very firm pressure was requisite before the tenderness was elicited On the other hand after a crisis, a comparatively slight pressure resulted in the production of intense epigastric pain, whilst prolonged pressure caused the onset of nausea and retching These facts seem to indicate that the pain and tenderness are

induced by the stimulation of afferent nerves terminating in the wall of the stomach, which are pressed upon as they traverse either the solar plexus or the walls of the stomach

Roux considers that the source of local tenderness in gastric disorders is the solar plexus Hurst, on the other hand, discounts this theory on the ground that irritation of afferent fibres is always referred to their peripheral distribution He supposes as an alternative that the seat of tenderness is the nerve-plexus in the subperitoneal areolar tissue However the fact that this form of pain is only evoked on strictly local pressure would seem to suggest that the solar plexus might be the source of local tenderness Consequently the hyperirritable gastric nerves would first interpret the stimulus followed secondly by the less irritable nerves to the other viscera, and hence the later more diffuse aching pain

Lastly, the irritation of vagal fibres would upset the motor activity of the stomach, producing nausea and retching

Since much of the reasoning in the foregoing paragraphs depends on the question of visceral sensibility and the localization of sensory impulses by visceral nerves, some experiments were undertaken to demonstrate this possibility In several patients with a colotomy in the left iliac region, the visceral peritoneum was carefully tested by pin, cotton-wool, and stretching with forceps In every case there was no response The peritoneal coat was divided, and the muscle coat subjected to similar tests In two of these cases it was found that on pinching the bowel (so as not to disturb the wound) at certain points a sensation of touch was evoked The sensitive points in both cases were situated about a quarter to half an inch apart no degree of stimulation between these points produced a sensation It was also noticed that the sensation was experienced after a latent period following stimulation, and, roughly tested, this period was constant for approximately equal degrees of stimulation , also that the sensation subsided gradually The patients described the sensation as resembling a light touch of something internal, and persisted that there was no similarity to a light skin touch Similar tests applied to the mucous coat yielded entirely negative results These results could not be obtained forty-eight hours after opening the gut, presumably owing to necrosis Both these patients localized the point of stimulation fairly accurately as regards the region It would thus appear that the sigmoid colon possesses a certain degree of sensibility, protopathic in character, which is very pronounced in certain individuals These results corroborate the conclusions of Head, who regarded the sigmoid as possessing a low form of protopathic sensibility Meltzer also found that on pinching intestines through an open laparotomy wound, pain was elicited Hurst stated that in his experience localization of sensory stimuli is always very accurate in comparatively fixed viscera such as the gall bladder whereas in the more movable parts the sensations are referred only to a general area

These conclusions regarding visceral sensibility may now be applied to the stomach Seeing that the lower part of the alimentary canal, as represented in our experiments by the sigmoid colon is supplied with afferent sensory fibres, and that in some cases the stimuli traversing such fibres are fairly accurately localized, it is to be expected that a part of the alimentary canal such as the stomach, having far higher functions to perform would be more adequately supplied with afferent fibres, and consequently sensory stimuli would be more accurately localized For example, if the attachments of the stomach are dragged upon when a laparotomy is performed under spinal anesthesia acute pain results from the tension on the gastric nerves, which is fairly accurately localized by the patient to the upper left abdomen However, seeing that this viscus is freely movable according to the above conclusion of Hurst one would expect that painful stimuli arising therefrom would be located to a general area occupied by the stomach Therefore in the disease under consideration, it would be reasonable to expect that any sensory impulses arising from the stomach might be referred to the gastric area This would account for the localized epigastric pain

We must now discuss the possible pathways by which the visceral sensory stimuli

are conveyed to the central nervous system In the majority of cases these sensory symptoms are by far and away the most profound, and hence, from the operative standpoint, it is of the utmost importance to determine the nerves implicated There are two possible channels of conduction (1) *The vagi* , (2) *The sympathetic*

1 *The Vagi* —The part the vagi play in the conduction of this visceral sensation may be considered first With regard to the three cases here discussed, it is apparent that if the vagi do conduct sensory impulses they are certainly not alone in this respect, as evidenced by the superficial radiating pain along the dorsal nerves, which appears strongly to indicate an associated irritation of the sympathetic fibres passing between the stomach and the posterior spinal roots definitely suggesting that the conduction of the visceral pain is not purely vagal In determining the relative importance of the vagi, the results of Exner s operations for gastric crises must be recalled In one of his patients vagotomy completely relieved the pain, indicating that painful afferent stimuli may traverse the vagi, which is further evidenced by the fact that in some cases extensive bilateral rhizotomy fails to relieve the epigastric pain According to Head's observations there are purely vagal crises accompanied by hyperæsthesia in the temporal and parietal regions From such facts it is evident that the vagi participate to a certain degree in the conduction of these visceral sensory impulses during a crisis

2 *The Sympathetic* —On the other hand, it is clearly borne out by operative results that the sympathetics are the principal conductors of the irritative impulses*, in that many cases of gastric crises are cured or vastly improved by posterior rhizotomy The significance of epigastric tenderness is here of manifest importance In *Case 2* there was no deep epigastric tenderness after a bilateral rhizotomy had been performed, whereas in *Case 3*, when there was only a unilateral rhizotomy the tenderness persisted, probably indicating that in the latter case the impulses still traversed the undivided posterior roots It is to be expected *a priori* that the sympathetics would be irritated, seeing that the disease is primarily located in the neighbourhood of the spinal cord

The effects of sympathetic stimulation were observed in *Case 3* After operation there had been no recurrence of crises up to the time when these observations were made Adrenalin chloride (10 mm 1–1000 solution) was injected subcutaneously into the flank This was immediately followed by an excruciating vice like pain which ascended the centre of the spine from the wound to the occiput The symptoms were speedily relieved by inhalation of amyl nitrite (3 mm) A little later there was a gradual increase of the local deep epigastric tenderness and pain, culminating in a typical gastric crisis which lasted forty-eight hours Amyl nitrite also temporarily relieved the epigastric pain Before the crisis the blood pressure (brachial) stood at approximately 130 mm Hg , during the crisis it rose to a mean of 175 mm Hg As a result of the success following administration of amyl nitrite, trinitrin tablets were prescribed The blood-pressure was reduced to 85 mm Hg , all symptoms of pain subsided, although nausea still persisted for some days after the crisis

These results strongly suggest that sympathetic irritation is the major factor in the crisis The investigations of Langley showed that stimulation of the abdominal sympathetic or the white rami communicantes causes a rise of blood-pressure not observed on vagal stimulations Again turning to Exner s cases, the second patient was not relieved from pain by vagotomy, clearly indicating the dual mode of transmission of these sensory impulses At this juncture it is interesting to draw attention to the pain in herpes zoster In this disease the visceral pain is sometimes experienced quite apart from any superficial intercostal sensations Hurst considers it to be a true visceral pain referred along the visceral sympathetic by irritation at the posterior root ganglia a similar anatomical situation of irritation as that under consideration

We therefore conclude that both vagi and sympathetics share in the conduction of the visceral sensory impulses , that the latter are in most cases the principal transmitters,

* Roux found that the fine nerve fibres which connect the dorsal roots to the cells in the sympathetic ganglia were partially degenerated in tabetic subjects

although the former participate, whilst in some cases the sensory symptoms are entirely due to vagal activity

II—MOTOR PHENOMENA

The motor symptoms of the crises, the vomiting, is still to be considered   Miller after a series of experiments on cats, found that stimulation of the vagi alone produced vomiting, in both of Exner s patients, vagotomy completely relieved this symptom Turning to the results of posterior rhizotomy with this particular symptom in view, we find that nausea and vomiting are the invariable symptoms in those patients who relapse   Rhizotomy has severed many of the channels of irritation but sooner or later the vagi are again irritated and the storm breaks once more

Possibly the irritation reaches the motor centres of the vagus through the mediation of either the afferent vagal fibres or those fibres of the splanchnics which are connected with the unsevered spinal nerve-roots   In the cases under our observation, signs of sensory irritation definitely preceded nausea and vomiting   We therefore consider that vomiting is produced solely by the motor activity of the vagus, secondary to reflex irritation of the nucleus of that nerve, either through the sympathetics or its own afferent fibres   Lowering of the blood-pressure alone did not entirely abolish nausea and occasional retching although severe vomiting was checked   This seems to indicate that although high blood-pressure might stimulate the vagus centres, its mitigation does not mean a complete cure of the crises—presumably on account of the persistent increased irritability of the afferent vagal fibres resulting in the transmission of sensory impulses that normally do not stimulate the higher centres or pass the threshold of consciousness *

In terminating this discussion on the nervous pathways which are concerned in the production of the various phenomena constituting a crisis we will briefly review our conclusions

1 That pain is present in two forms, superficial and deep

2 That the superficial pain is of two types, the one a radiating pain definitely localized along the dorsal nerves   the other a diffuse constricting sensation

3 That the pain along the dorsal nerves is due to the irritation of afferent fibres in the posterior nerve-roots

4 That the superficial diffuse pain is associated with retention of deep muscle sensibility in the anæsthetic area, and is possibly due to the presence of afferent fibres in the anterior nerve roots

5 That the deep epigastric pain is a true visceral pain and is associated with local tenderness and is probably due to conduction via the sympathetics, i e by the splanchnic nerves and the posterior roots, and slightly by the vagi

6 That the vagi are the principal conductors of the sensory impulses in a certain type of crises where vomiting is a predominating symptom, accompanied by pain localized to the epigastrium and hyperesthesia of the temporal and parietal regions

7 That the vomiting is entirely due to vagal activity

8 That irritation of the visceral sympathetics followed by vasomotor spasm is probably the precursor of a crisis

THE OPERATIVE TREATMENT OF CRISES

If the subject is viewed broadly, it is apparent from the preceding facts that these two main types of symptoms of the crises the pain and vomiting, are each dependent upon the integrity of distinct nerve-channels   the pain upon the sympathetics, the vomiting upon the vagi   In order to be completely assured of a cure in all cases, both series of

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* An illustration of normal sensory stimuli being consciously interpreted by a hyper sensitive mind. Drs Stewart etc a case where a patient with right sided hemi anæsthesia and loss of special sensation all d so that she had recurrent appendicular pain and vomiting although operation yielded a negative result

nerve paths would have to be severed   Since such a proceeding would be too drastic for the condition of the patient in most cases   not to mention the physiological sequelæ, it is obvious that only one or other of the main symptoms can be attacked   In a case where vomiting and other signs of vagal irritation are present   vagotomy might be considered, bearing in mind that serious gastric stasis may result whilst any concomitant sympathetic pain will not be alleviated *

In a case where pain is the principal symptom, section of the sympathetic fibres or their connections is indicated   The sympathetic route has been attacked in three different parts

1   In the spinal cord by Souttar, who divided the anterolateral ascending tract between the 2nd and 3rd dorsal nerves   The immediate results were satisfactory   Complete hemi-analgesia below the level of section resulted, though one or two painless vomiting attacks occurred

2   The posterior roots of the dorsal nerves by rhizotomy

3   The solar plexus, which was stretched by Leriche and Doufourt in four patients, resulting in a temporary alleviation of the crises

We may dismiss the last-mentioned operation from further consideration, seeing that it is highly improbable that a permanent result could be obtained from such a procedure   Passing on to consider the other two operations, we have here a means of alleviating pain, the most fearful and prominent symptom in the majority of the crises

Posterior rhizotomy severs the nerve channels conducting the majority of the irritating impulses, vagal irritation is thereby reduced to a minimum, and both pain and vomiting are relieved   In some cases such as that of *Case* 1, a unilateral resection is sufficient   though in most cases it is wisest to perform extensive bilateral rhizotomy

The physiological sequelæ are insignificant when compared with vagotomy   As regards Souttar s operation   we are confronted with a far more delicate and dangerous proceeding   and since such a satisfactory result usually follows the simpler and less risky procedure of rhizotomy, provided care is taken in regard to the selection of cases   it appears difficult to imagine any reason for selecting the more complicated treatment in preference to the simpler procedure of rhizotomy

The operation of rhizotomy in most selected cases alleviates the symptoms very considerably   In 64 cases of Foerster s, 29 were completely cured and 18 considerably improved   Radicality of resection is essential   Foerster cites a case of Kuttner s where, after rhizotomy there was an intervening sensitive skin area wedged in between the two halves of the anæsthetic field   This was the seat of excruciating pain   only cured on extirpation of the ganglia †

The most satisfactory results have followed bilateral rhizotomy   Foerster performed bilateral rhizotomy of the 6th to 10th roots inclusive in one case   in another of the 6th to 11th roots inclusive, in neither was there a return of crises   On the other hand, Thomas and Hall resected the 7th, 8th, and 10th roots   the case relapsed in four months' time   A small resection answers satisfactorily in some cases where the symptoms have been very local in character, is in Sir William Thorburn s patient, *Case* 1   However, another possibility presents itself with this patient   Here it will be remembered that there was distinct evidence of the anterior roots having been severed   and it was pointed out that in this patient there was an absence of either type of superficial pain   These facts suggest an extension of rhizotomy to include a few of the anterior roots in the lower thoracic region, since *Case* 1 apparently experiences no distress from the paralysis of the few intercostal muscles on the one side only   This proceeding would ensure the abolition of those deep sensory impulses which appear to traverse the anterior roots without any serious physiological sequelæ

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* Exner performed vagotomy upon two cases of gastric crises   In one the vomiting and pain were relieved   but serious gastric stasis ensued necessitating drainage between the stomach and duodenum   In the other case   vomiting was relieved but pain returned
  † Cullke first resected the 7th to 9th roots   and crises temporarily ceased   After relapse, a second operation was performed   the 10th and 11th roots were resected and the crises cured

It will be necessary to investigate by experimental methods the correctness of the hypothesis that afferent fibres from the subcutaneous tissues enter the cord by the anterior roots, and I am at present engaged upon this work and hope to publish the results in the near future

Finally we may review the possible beneficial results from the operation of rhizotomy In this procedure we possess a means for combating both the motor and sensory symptoms of a crisis, by section of the posterior nerve-roots we can abolish the superficial radiating pain, and either cure or considerably mitigate the visceral pain in most cases Again, the reflex irritation of the vagal centres is diminished by the elimination of the irritative afferent impulses ascending the splanchnics Consequently, in minor cases the vomiting ceases, or in severe cases is considerably alleviated Again, by section of the anterior nerve roots we probably possess a means of curing the diffuse type of superficial pain, and perhaps of still further diminishing those impulses likely to irritate the vagal centres, though this latter deduction awaits experimental confirmation

It therefore seems reasonable to conclude that rhizotomy is most suitable for the majority of cases, that it is based on sound physiological principles and is a procedure that when carried out to a degree proportional to the severity of the symptoms, affords a reasonable prospect of considerable alleviation, or of cure, of gastric crises

In concluding, I must express my gratitude to Professor J S B Stopford for his kindness in reviewing the manuscript and also for his many helpful suggestions

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SHORT NOTES OF
RARE OR OBSCURE CASES

A CASE OF MULTIPLE PULSATING BONE TUMOURS

By J RENFREW WHITE, Dunedin, New Zealand

Clinical History—The patient, J W F, age 28, a commercial traveller, was first seen by the writer in consultation with Professor L E Barnett on May 22, 1920   He was then complaining of (1) A painful swollen and stiff right knee , (2) A painful swollen right heel , (3) Varicose veins of the right calf

Twelve months before, the patient knocked his right knee with some violence against a counter   This caused him little immediate pain or disability , but during the next few weeks the knee gradually swelled and became painful and stiff   He consulted two doctors in turn , one of these diagnosed tuberculous, the other syphilitic arthritis   Ten months later he inflicted a further and more severe injury on the joint by knocking it against the pedal of a motor bicycle   a sudden crack was heard, and the leg instantly became useless and the joint enormously distended—a distention that had only slightly subsided when seen by the writer, despite two months' immobilization on a back splint   Some three years earlier, whilst the patient was on military service in camp, he had some trouble with his right heel—pain and swelling—but this had soon subsided   Eight months before the patient was seen, however, four months after the first accident to the knee, his heel again became tender and swollen, and painful to walk on   The varicose veins he had noticed for some months , he had attributed to these the swelling of the heel

Personal History—He has had no previous illness , he denies the possibility of venereal disease   his father died of consumption

Fig 459 —Radiograph showing the remarkable decalcification of the os calcis

On Examination—The *knee joint* on inspection, was considerably swollen, particularly on the inner side , the joint was held flexed at 30°   there was obviously even with the knee flexed, a considerable degree of genu valgum   there was marked wasting of the thigh muscles   The joint was hot on palpation   The swelling was largely due to infiltration of the peri-articular soft parts, there being very little actual fluid in the joint   The knee could not be fully extended passively although the range of passive flexion was normal   The *heel* was thickened and swollen, especially on either side of the tendo Achillis and on the plantar aspect   The os calcis was exceedingly tender to pressure from all sides   The branches of the internal saphenous vein were markedly varicose on the right side not at all so on the left

X-ray Examination (*Fig* 459) showed marked decalcification of all the bones of the foot   this reached a maximum in the case of the os calcis in which, indeed, actual cavity formation seemed indicated   The lower end of the femur showed a similar change, with however, signs of a recent pathological fracture of the condyles

In view of the clinical and skiagraphic evidence, pointing to the existence of a chronic destructive bone lesion in both places, a diagnosis of tuberculous disease of the lower end of the femur and of the os calcis was made This diagnosis seemed all the more justified in the light of the family history of tuberculosis

Operation, May 26—After the application of a tourniquet, the os calcis was exposed on its plantar aspect by the turning down of a heel flap, the bone was found to consist of a mere shell of bone filled with an oedematous tissue indistinguishable to the naked eye from tuberculous granulation-tissue, there was, however, no sign of caseation or pus-formation The lesion was treated as an ordinary osteomyelitic cavity—the granulations were scraped away, the walls of the cavity resected to allow of complete immediate obliteration of the dead space by pressing up the tissues of the heel flap to fill it The whole limb was then immobilized in plaster before the releasing of the tourniquet, the knee being straightened as far as possible Unfortunately none of the 'granulation tissue' was preserved for microscopical examination The wound healed by first intention and the lesion gave the patient no further trouble, the disease process had been eradicated and did not recur

Aug 24—The plaster was removed The operation wound was found to be soundly healed, the condition of the knee much as before

Oct 19—The plaster was again removed, and the inflammatory signs in the knee-joint were noted to be not subsiding is expected is a result of the continued immobilization, the patient was warned that the disease was not reacting

to this conservative treatment and that an operation on the knee might prove necessary, the plaster was renewed

Nov 23—The patient came complaining of pain about the middle third of the leg, the plaster was removed An extraordinary change was at once seen to have taken place, the knee-joint was more swollen, especially over the internal condyle, and was pulsating visibly, a marked systolic bruit was to be heard over the joint with the stethoscope *Fig* 460 shows the condition of the lower end of the femur at this period There was no change in the condition of the heel In the middle of the leg, over the front of the tibia, was another pulsating fluctuating tumour, and over this too a loud bruit was audible The most amazing change, however, was a complete solution of continuity of the shaft of the tibia, a spontaneous fracture at the level of this pulsating swelling Confirmation of this was supplied by radiography (*Fig* 461)
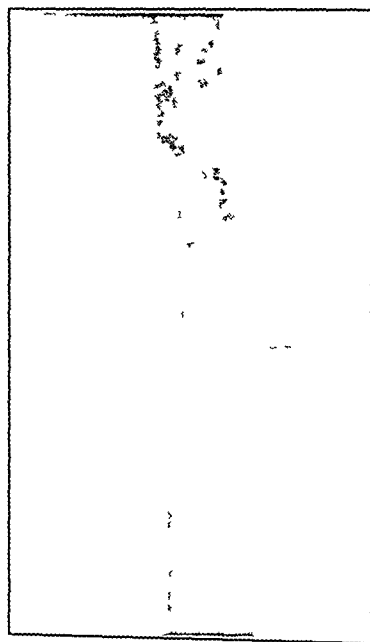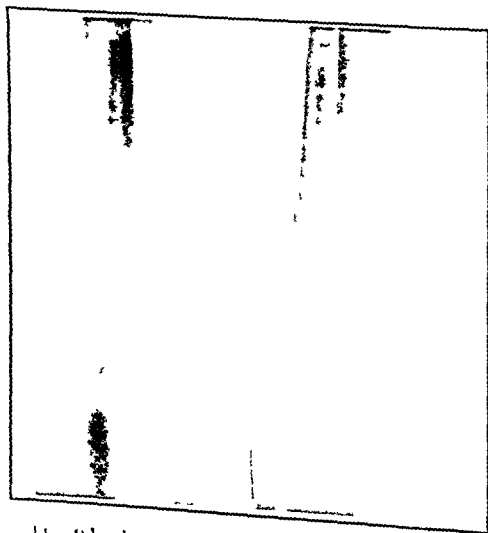
It was now obvious that a destructive bone lesion similar to that originally present and still developing in the condyles of the femur, and to that apparently eradicated from

the heel, had developed in a third place in the skeleton of the same limb , moreover, the obviously vascular nature of these lesions made it clear that they were not tuberculous, as at first thought, but neoplastic—probably sarcomatous   Careful clinical and skia-graphic examination of the patient failed to detect signs of visceral metastatic foci or glandular involvement

Dec 27 —The limb was amputated through the middle of the thigh

Examination of the amputated limb showed the femoral condyles to be excavated, expanded, and at several places perforated by a very soft vascular friable tissue, which had invaded the adductor magnus muscle and in places, the knee-joint   The tibial tumour (Fig 462) was of a similar structure and appearance, and had destroyed and replaced

FIG 462 —Photograph of tibia with tissues reflected including superficial layers of peri-osteum   At the junction of the lower and middle thirds of the bone the tumour described is seen

two inches of the shaft of the bone without, however, having perforated its periosteal sheath An incision into the heel and remains of the os calcis showed but ordinary scar tissue and nothing to suggest a recurrence of the tumour growth

The following is the pathological report kindly supplied with microphotograph by Professor Murray Drennan —

NAKED-EYE APPEARANCES OF SPECIMENS Femur —The lower end is extensively occupied by a softened hæmorrhagic mass, especially involving the cancellous tissue of the internal condyle   but also extending into the corres ponding tissue of the external condyle   The cartilage is not penetrated but several small rounded nodules of growth are seen at attach ments of the crucial ligaments   The growth extends upwards into the lumen of the shaft for almost 7 5 cm   and shows no encapsulation of the growing margin   Mesially the growth extends through the bone and periosteal tissue, bulging towards the surface but sharply defined by a fibrous layer over it   The bone marrow of the shaft shows the normal fatty appearance

In the knee-joint are small hæmorrhages along the synovial membrane anteriorly and mesially, a larger hæmorrhage occurs in the substance of the cartilage of the internal articular surface of the tibia   The external articular sur face shows superficial erosion of the cartilage

Tibia (Fig 462) — In the middle of the shaft is an oval swelling, roughly 6 cm in its long axis, which has eroded the bone and led to 'spontaneous fracture   The outer layers of periosteum can be stripped off, still leaving a fibrous layer adherent to the tumour On section this tumour is seen to bulge more anteriorly   It is light red in colour, mottled with darker red areas of hæmorrhage, and has a delicate white reticulum throughout It has invaded and absorbed the bone, but the margin is sharp between the tumour and dense bone and marrow   In the substance of the tibialis posticus is a small rounded nodule of tumour of similar appearance to the above described nodule in the tibia

Os Calcis —This is collapsed only the portion adjacent to the calcaneo astragaloid articulation remaining   This is where a former surgical removal has been performed, and is now marked only by scar tissue and some old blood-pigment, no tumour tissue being recognizable

MICROSCOPICAL APPEARANCES —Portions of the nodule in the tibia were cut and examined without requiring any decalcification   The essential part of the tumour consists of masses of cells arranged as solid acini and bounded by delicate capillary vessels   In parts the cells directly abut on the outer side of the endothelium of these vessels , in other parts there is a cellular fibrous matrix between capillaries and tumour cells   The tumour cells are large and rounded or polygonal   They are closely packed in acinal fashion   Individual cells vary considerably in size , all have a rounded or oval nucleus, poor in chromatin but with distinct nuclear membrane and nucleolus   The cell body is relatively large, and stains uniformly with eosin   Considerable variation in size occurs, and large cells with several nuclei are not infrequent   Mitotic figures are few   No intercellular substance is demonstrable (Fig 463)

Hemorrhages are numerous and, in places, extensive   Many tumour masses show hemorrhage in their centre, so giving an appearance of a blood-space lined by tumour-cells and suggesting, at first sight, an angiosarcomatous type of growth , that this is not its nature seems clear from the less altered parts of the growth   Small spicules of bone appear amongst the tumour cells   in some cases the cells directly abut upon, and even seem to be within, the spicule   in other cases the spicule is sheathed by collagen fibrils   Larger blood-spaces occur   but these also have a wall of endothelium only, or with little supporting connective tissue   An occasional vein, having the usual structure, is seen with its wall permeated with tumour cells

Whole fields show nothing but haemorrhage, some recent, some organizing   Some fields show only a vascular and connective tissue framework   the tumour-cells having disappeared   The 'capsule of the tumour consists of strands of fibrous tissue, in places permeated by tumour cells which here appear as flattened solid strands   In part this 'capsule' is separated from the subjacent tumour by organizing haemorrhage   The dense bone adjacent to the tumour was decalcified   sections of this show the tumour masses penetrating between trabeculae with erosion of these, while other parts show new bone-formation just beyond the invaded areas

FIG 463 —Microphotograph of portion of tumour in tibia   In the centre is seen a thin walled blood vessel   Around are groups of tumour cells arranged roughly in alveoli, some solid, some with a central space   Haemorrhage is seen amongst the tumour cells towards the right and lower part of the field   (× 300)

The nature of the tumour is not clear at first sight   In parts the structure suggests an epithelial growth   other parts suggest a malignant vascular tumour   A fuller study of the less altered and apparently freely-growing areas leads one to the view that it is a sarcomatous formation corresponding to the usual description of 'alveolar sarcoma'   The cells have not the arrangement or appearance of a myeloma, and their close relation to the vascular scanty stroma, together with the extensive haemorrhages rather exclude an epithelial origin   also the situation is against this   The pulsatile character noted clinically is easily understood from the structure of the tumour

This case has seemed to the writer worthy of record for the following reasons —

1 It shows the importance of pathological examination of all specimens obtained at operation even in cases in which the diagnosis seems certain on clinical grounds

2 It shows the importance of guarding against a routine diagnosis of every chronic inflammatory joint condition that is not syphilitic or gonococcal is certainly tuberculous in nature

3 The rarity of multiple pulsating tumours of bone

4 The fact of the three foci occurring independently in three different bones of the one limb

CIRCULUS VITIOSUS FOR FOURTEEN YEARS AFTER GASTRO-ENTEROSTOMY

By W G SPENCER, London

THE patient, at the age of 30, whilst out hunting, was thrown off by his horse falling at a fence He was helped to remount, after which he was able to ride home by himself He felt bruised all over and stayed in bed for a day or two, but after a month again rode hunting For a time he felt nothing wrong except a tendency to stitch in the left side, such as he had often had as a boy but not subsequently Gradually he began to suffer from indigestion and vomiting of bile (*Fig* 464), and, as the trouble continued to increase, he consulted a number of physicians and surgeons, and underwent several courses of treatment in nursing homes

Ten years after the accident he consulted Sir Lauder Brunton when the question of injury was certainly considered, for Brunton mentioned the case of a man who had

IIG 464 —Before gastrojejunostomy First part of jejunum (J 1) fixed in U shaped loops by adhesions of visceral peritoneum causing regurgitation from duodenum (d) through pylorus (py) into stomach (St) of some bile from bile duct (b) and pancreatic juice from pancreatic duct (pa)

been knocked down by a buffalo in Africa, and advised the patient to submit to an operation by Mr Arthur Barker similar to the one performed in that case After the operation he was very ill, with frequent vomiting, and some of the sutures gave way He learnt that the operation had failed because the surgeon had been prevented from doing what he had intended by the continuous vomiting under the anæsthetic Presumably Barker would have proceeded to excise the constricted intestine During the following fourteen years the complex of symptoms puzzled those who did not know that gastrojejunostomy had been done

What really happened was that the food passed immediately out of the stomach into the second part of the jejunum, whilst, behind the food, bile and pancreatic juice collected in the stomach Soon after taking food the patient began to feel uneasiness in the lower abdomen, which increased up to a degree of colic, and with some tendency for pain to concentrate itself in the ileocæcal region Concurrently nausea set in, which passed off without, or after, bilious vomiting On an average every third day he vomited as much as half a wash-hand basin full of bilious fluid mixed with little or no food There was complete relief between meals, and sometimes digestion occurred without disturbance X ray examinations either gave no information, or appeared to show a delay at the ileocæcal valve Hence the patient was advised several times to have his appendix removed, but was deterred by his previous experience About three months before the second operation Dr Ironside Bruce noted that, preceding the delay at the ileocæcal valve, the stomach had emptied very rapidly There was no obstruction in the colon to a barium enema What amounted to an attack of seasickness every second or third day became at last unbearable He was a tall spare man with rather haggard features, age 54, carrying on a large business and able to walk all day shooting Except for the vomiting there was nothing abnormal observed On the day before the operation after having been in bed for a couple of days, and one hour after a light lunch, he vomited more than two pints of bile, pancreatic juice, and gastric fluid, unmixed with food This corresponded with

the vomiting which had continued since the previous operation, and upon it was founded the diagnosis of a circulus vitiosus following gastro-enterostomy

The epigastrium having been laid open through the scar of the previous operation it was noted that there were no adhesions between the visceral and parietal peritoneum the stomach and transverse colon were normal as to size and position the wall of the stomach was thin, and the pylorus appeared particularly small, resembling that of a boy   The omentum and transverse colon were then turned up   the omentum not being adherent to the underlying intestines   There was now exposed a length of dilated and thick-walled small intestine directed vertically downwards from the lower border of the stomach (*Fig* 465)   This gut was of much larger lumen   and its wall thicker, than the transverse colon   To the left of it were coils of small intestine folded into U shaped loops by a veil of fibrous adhesions involving only the visceral peritoneum   Further exploration showed that these U-shaped loops involved the upper third of the jejunum, the constriction commencing about three inches beyond the duodenojejunal junction and terminating by opening into the stomach   This formed the afferent limb of the gastrojejunostomy, whilst the dilated intestine above noted constituted the efferent portion   The first step was the implantation of the

FIG 465 —Following gastrojejuno tomy Jejunum beyond U shaped loops conducting all bile and pancreatic juice into stomach All contents of stomach passing directly into second part of jejunum (J 2)

beginning of the jejunum into the left side of the second part of the jejunum about three inches below the gastrojejunostomy   next followed the excision of the constricted first part of the jejunum including the narrow opening into the stomach   A well-marked spur separated it from the efferent opening, which was large enough to admit

FIG 466   After Roux—Y shaped anastomosis and excision of first part of jejunum

three fingers   On account of the atrophied appearance of the pylorus, through which very little food could have passed for fourteen years, it seemed unwise to do away altogether with the gastrojejunostomy   so after cutting out and closing the afferent opening, the efferent orifice was reduced by suturing (*Fig* 466)

The gastrojejunostomy opening, as it was found fourteen years after being made, might be imitated by cutting longitudinally into the stomach, on its posterior aspect just above the greater curvature   Then, taking a coil at the junction of the upper and middle third of the jejunum   and making a transverse incision into it across more than half its lumen, if such a transverse opening were joined to the longitudinal opening a well-marked spur would necessarily be formed in the jejunum as a result

So much attention had been directed to the appendix that in order to clear up the matter, it was exposed and removed through a separate incision   There was no well-defined abnormality   either in the appendix or in the cæcum

The Y shaped anastomosis called Roux's method put a stop entirely to the regurgitation of bile   and now there is no trouble with digestion so long as the patient observes ordinary care

TORSION OF THE GALL-BLADDER

By HUGH LETT, London

In the British Journal of Surgery, Vol IX, No 34, p 310, Mr Irwin reported a very interesting and successful case of torsion of the gall-bladder The condition is so rare that I venture to refer briefly to a somewhat similar case It has already been reported fully (*Lancet*, 1909, i, 1099), but was recorded under the obscure title of ' Two Unusual Conditions of the Gall-bladder ', and so has escaped notice

History—The patient, a woman, age 72, was admitted to the London Hospital on Aug 1, 1905, with the following history Three days previously she had been suddenly seized with severe pain in the right hypochondrium, which persisted until her admission to hospital She had vomited four or five times, and the bowels had not acted since the beginning of the attack She had never had similar pain before, no history of gall-stones

On Admission—Her temperature was 101°, and her pulse-rate 100 There were great tenderness and rigidity in the right upper abdomen, and a rounded tumour could be felt in the region of the gall-bladder The abdomen was distended A diagnosis of acute cholecystitis was made

Operation—A vertical incision was made over the swelling, which was found to be an enlarged gall-bladder with numerous recent adhesions to the omentum and hepatic flexure of the colon The gall bladder was black and the size of a large pear It was tapped, and black fluid containing altered blood and a little bile was drawn off The wall of the gall-bladder was much thickened from hæmorrhage into it On palpating the cystic duct, a nodule was felt, which I thought at first might be a gall stone, but on separating the adhesions, I found that it was due to axial rotation of the gall-bladder on the cystic duct, the nodule having been produced by twisting the duct The twist was easily undone, and consisted of four half-turns from left to right (counter-clockwise) The gall bladder and part of the cystic duct were excised

The patient collapsed suddenly twelve hours after operation, and died in a few hours

Post-Mortem Examination—No gall stones were found The kidneys were markedly granular, but otherwise nothing of importance was discovered On examining the gall bladder after its removal, it was found to be completely surrounded by peritoneum, and its only connection with the liver was a narrow mesentery which left the gall-bladder in the neighbourhood of its neck and included the cystic duct

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TORSION OF THE HYDATID OF MORGAGNI

By G H COLT, Aberdeen

A boy, age $14\frac{1}{2}$, admitted on Aug 21 1921, into Professor Marnoch's ward at the Royal Infirmary, Aberdeen

History—Six days before admission he was pushing a heavy stone to move it He felt nothing wrong at the time, but eight hours later, as he was getting into bed and again when he turned on his left side, he felt pain in the left side of the scrotum, which began to swell The pain was severe, and he felt sick and vomited During the next four days he had several attacks of pain in the same region, relieved by rest and brought on again by movement, there was no sickness or vomiting The swelling increased gradually On the fourth day he lifted a 28-lb weight at a Highland Games, and he thinks the swelling became slightly larger then, but it was always continually growing On the fifth day he felt sick but did not vomit During the six days the bowels acted as usual On the sixth day his doctor saw him and sent him into hospital

On Admission—The general condition was good The left half of the scrotum was diffusely swollen, œdematous, red, tender, and warm to palpation The swelling was limited to the left side of the scrotum and was non translucent There was no impulse on coughing There were two enlarged glands in the left groin The temperature was 98 8°

Operation —Under general anæsthesia the left side of the scrotum was incised and turbid fluid evacuated from the cavity of the tunica vaginalis   The pedunculated hydatid of Morgagni was greatly swollen and blue-black   It was adherent by recent lymph to the testicle and epididymis   Its pedicle was twisted three times anti-clockwise, and arose from the junction of the testicle and epididymis, but owing to the œdema, the exact site of origin of the stalk could not be traced further   The pedicle was ligatured and the mass removed   The tunica vaginalis and skin were sutured   Except for a slight discharge of serum the wound healed by first intention   No culture of the fluid was made

Pathological Report —The specimen in the recent state measured $1\frac{1}{2}$ in by 1 in by $\frac{7}{8}$ in   It was hardened and prepared before being opened   The pathological report is as follows   " The cyst contained deeply blood-stained fluid   The wall and pedicle were infiltrated with effused blood, which to a considerable extent masked the structure   The wall of the cyst was formed of fibrous tissue, and there appeared to be a thin lining of a single layer of flattened endothelium or epithelium "

The stalked hydatid may vary in size and position, and more than one may be present   In this instance the size might be considered to be against the specimen actually being the stalked hydatid, but it corresponded exactly with it in anatomical situation, and no other hydatid was present   Mr Edred M Corner has kindly written to me about the matter, and states that there is one other case on record   Half of the specimen has been forwarded to the R C S Museum, and the other half has been placed in the Surgery Museum at Aberdeen University

I am indebted to Professor Marnoch for his permission to record the case

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CONGENITAL STRICTURE OF THE ANUS PERSISTING INTO ADULT LIFE ACQUIRED MEGALOCOLON

By GEORGE ROBERTSON, Dunfermline

This case was referred to me for treatment by a colleague on June 2, 1921   The patient was a male, age 20

History —From birth to the present time patient had suffered from difficulty in defæcation   He was noticed, while quite a baby, to have a prominent abdomen   This prominence has kept pace with his general growth, and recently has become more pronounced   At birth he suffered a head injury owing to difficult instrumental delivery, and his skull shows a marked deformity over the right frontoparietal region   He has never been very bright mentally, yet he is quite intelligent, and shows no definite degenerative stigmata   With the exception of the abdominal symptoms, colicky pains and difficult defæcation, he has had no other troubles   For some weeks before admission into hospital he had been suffering rather more than usual from abdominal pain   His appetite has always been good, and he has had no gastric disturbances

On Examination —He shows a dry skin and a sallow complexion   His general muscular development is poor   He is slightly anæmic   The whole abdomen is much distended   Palpation gives a peculiar sensation to the examining hand   Over the whole abdomen one feels as if pressing on an extensive putty-like mass, into which the fingers can be made to sink deeply, thus to leave a visible indentation   In the cæcal region, there is a special prominence, about the size of a small football, this, on deep pressure, gives the same putty-like sensation as is felt in the other regions   This prominence is dull to percussion   No peristalsis is visible over the abdomen, except over the cæcal prominence, which is seen to rise and fall somewhat, but does not disappear

Operation —A few days after admission I gave him a general anæsthetic, and then found, upon attempting to explore the rectum, that the tip of my forefinger was soon arrested, just inside the anus, by a very tight, wiry edged annular stricture, having as its exact site the line of junction of skin and mucous membrane   Concluding that this, at least was a definite deformity, I incised the fibrous ring, and, more deeply, the sphincteric muscles   It was now easy to explore the rectum   This was found greatly distended

by a large hard fœcal mass, quite as large as a fœtal head   A laborious process was then begun   Aided by suprapubic pressure the rectal mass was fixed, broken, and then delivered   Many such 'deliveries' were repeated, until the whole colon from the cæcum downwards was emptied   The quantity of fœces removed was really extraordinary   It filled to overflowing a large wash-hand basin   Most of the fœcal matter had little odour, but that last evacuated was softer in consistence and quite offensive   The rectum and lower colon were then irrigated with warm boric lotion   There had been a fair amount of trauma inflicted upon the rectal mucosa, and such irrigation seemed advisable   In order that the sluggish colon might not have to overcome any future anal difficulty, I made no attempt to repair the sphincteric muscles   The abdomen now presented an extraordinary contrast to its previous condition   It had become sunken and empty

For several days after operation the patient was very ill   Pyrexia, very frequent bilious vomiting, and a copious and persistent purulent and fœtid discharge from the rectum, combined to make his early convalescence stormy   The purulent rectal discharge persisted for several weeks, causing much emaciation   Having improved, he was then allowed to return home, after which his improvement was rapid

After-History—On Oct 17, four months later, he returned to me, now looking very well, and had gained in weight   He then expressed to me his appreciation of his improved condition, but wished to have his incontinence of fæces corrected

He was admitted again to hospital, when I found that his abdomen was quite satisfactory, there being no retention of fæces in any area   Deep palpation for a few moments produced a marked central prominence in the abdomen   This was quite painless, and lasted a few seconds only, it was evidently due to strong colon peristalsis   His appetite was good   Digital examination revealed an empty and evidently healthy rectum   The anus was, of course, quite patulous   Operation for repair of the sphincter was undertaken on Oct 28, and consisted in excision of the scar tissue from the previous operation, then suture of the muscle ends   Spinal anæsthesia was used (stovaine)

It will be interesting to watch the future of this case, I have little doubt but that he will remain quite well   The dilatation of his colon which had lasted all these years has now greatly disappeared   The hypertrophy is very evident still   It, too, will, no doubt, diminish as the need for powerful muscular driving passes away   It would be rather too much to expect that the colon will ever become quite normal, but the hypertrophy of its muscular wall will be an asset of some value in operating against the kinks and deformities one would expect to find resulting from the long-continued dragging of such an overloaded gut

During the patient's convalescence from his original operation, I frequently thought that the day was not far off when I would operate to remove his complete colon, to guard against a recurrence of symptoms arising from the deformity of the gut   I also looked forward with pleasure to the presentation of an interesting specimen to the Museum of the Royal College of Surgeons, Edinburgh   Nature has decided otherwise, and has probably intervened to the benefit of the patient's future health

Evidently the original anal stricture was of the nature of a thickened, persistent anal membrane, causing marked resistance to the passage of fæces   There are articles written on the subject of megalocolon which state that, in many cases, the anus has been found contracted   May not some of these cases with 'contracted' anus be similar to the case I have presented ?

It is probable that a complete ablation of the colon would have cured my patient, for thus the rectal content, becoming fluid, would have passed the anal stricture with fair ease   Such a procedure would, however, have been fraught with great danger without a preliminary emptying of the colon, and this, I fear, was quite beyond the therapeutic effect of purgative medicines   To have opened the bowel in any abnormal manner (artificial anus, etc) could not have accomplished the result attained by dealing with the case and its evident cause as I have indicated

The severity of the case, the long duration of the symptoms, and the simplicity of the treatment, furnish my excuse for putting the particulars on record

CHRONIC DUODENAL ILEUS

By P LOCKHART-MUMMERY, London

Mrs A S , age 36, admitted to St Mark s Hospital, September, 1921

History —The patient, a thin, spare woman, has been complaining of abdominal pain for the last eighteen months   The pain lasts most of the day, and is only relieved by lying down , it has no relationship to food, but patient has a poor appetite, and has been getting progressively thinner   Flatulence is not a prominent feature, but patient suffers from constipation a great deal   She vomits occasionally   No hæmatemesis, nor any sign of gastric ulcer   Patient has been under her doctor's care during the whole of this time, but the ordinary treatment failed to relieve her symptoms, and she is unable to get about owing to the pain

On Examination —There is a thin, flabby abdominal wall, and marked visceroptosis   Stomach rather enlarged   No tenderness

Operation —I opened the abdomen in the mid-line   The stomach and first and second parts of the duodenum were found to be markedly dilated , the third part of the duodenum and small intestines were collapsed   There was obvious obstruction in the duodenum at the point where the mesenteric vessels cross it   The colon was markedly prolapsed, and it was evident that in the erect position the drag of the intestines constricted the duodenum beneath the root of the mesentery (*Fig* 467)

I performed a posterior gastrojejunostomy   I did this in preference to a duodenojejunostomy, as it appeared to me to be a better operation in this case   In

Fig 467 —Chronic duodenal ileus   A Stomach   B Dilated first part of duodenum   C, Ileocolon cut across   D Dilated second part of duodenum   E Transverse colon   F Third part of duodenum   G Root of mesentery and superior mesenteric artery

my case the anastomosis would have had to be made between the second part of the duodenum and the jejunum, while the ampulla of Vater would have been just opposite the stoma   The result was quite satisfactory   and the patient has lost her symptoms   At the operation it was noticeable that the walls of the stomach and first and second parts of the duodenum were markedly hypertrophied as compared with the ileum, which was very thin

I should certainly not have recognized the condition had I not heard Mr Wilkie's paper at the Association of Surgeons' Meeting at Edinburgh   My case appears to conform exactly with the one described by him (*see* British Journal of Surgery, Oct , 1921, p 204), and seems to be an end-result of visceroptosis

The obvious treatment is to improve the condition of the abdominal wall by suitable exercises aided by a proper support , but when the abdominal wall has completely lost its power of contraction and the trouble has advanced to the stage that was present in this case it seems very doubtful whether anything short of operative interference will benefit the patient   Such cases appear to be rare, but now that our attention has been drawn to them we shall no doubt find a good many more than we expect   I think we owe a great deal to Mr Wilkie for having so ably demonstrated the condition

REVIEWS AND NOTICES OF BOOKS

Operative Surgery By J SHELTON HORSLEY, M D , F A C S , Attending Surgeon, St Elizabeth's Hospital Richmond, Va Large 8vo Pp 721, with 613 illustrations 1921 London Henry Kimpton 52s 6d net

IN the opening sentence of the preface, the author states that particular stress has been laid upon the preservation of physiological function and the interpretation of the biological processes that follow surgical operations, and he has succeeded in keeping this object to the fore Throughout the work it is apparent that a sound knowledge of general principles underlies the methods described and the application of technical details The earlier chapters on biological principles and surgical drainage are original and stimulating, and form a very good introduction to operative surgery The author does not claim to have included all surgical operations, but only those which he has himself found to be best suited to the indications for interference

In a book of this size, it is doubtless difficult to apportion space with due regard to the relative importance of the various subjects , but we think that for a general text-book some relatively important operations are not fully dealt with For instance, plastic surgery is discussed very exhaustively, whereas to the surgery of the thyroid gland, a much more important subject to the general surgeon is allotted only four pages No doubt the section on plastic surgery is good , the descriptions ne supported by many illustrations, and in some cases by photographs of the author's own patients both before operation and when sufficient time has elapsed to show the final results The chapters on the surgery of the blood-vessels are very complete, and contain a good account of the author's method of blood vessel suture, while only a reasonable amount of space is given to the ligature of vessels in continuity

In the chapter dealing with operations on the nerves, the author shows his real grasp of his subject when he writes (pp 149, 150) " Much of the disagreement in the value of results of nerve suture, and particularly of nerve transplantation, is due to the fact that some nerves regenerate more promptly and more satisfactorily than others, and that in some individuals the nerve tissue will regenerate very much better than in other individuals In a young healthy child, complete regeneration is much more probable than in an adult Experimental work in the lower animals may show better results in nerve surgery than are obtained clinically, whereas in tissue of less delicacy there is not the same difference in regeneration between the lower animals and man '

The chapters on bone surgery contain a good deal that is open to controversy, such as the advocacy of the use of medullary plug grafts and the uncompromising attitude towards the employment of plates, for on p 161 we read that ' a steel or iron plate should have no place in modern bone surgery " For the treatment of bone cavities, Moorhof s paste is recommended, and the author appears to prefer it to other methods which are merely mentioned and not described in detail

In the section devoted to amputations, very little is said about the kineplastic method, and there is certainly nothing in the brief references to the method to encourage the reader to try it The Dean Lewis method of excising the whole (sic) breast is described in some detail, and no less than four illustrations are devoted to this unsurgical procedure For umbilical hernia, the author expresses great confidence in the Mayo operation , but in this, as in other similar instances, no statistical evidence is given

Many of the newer operations are described and figured, as for instance the Kondoleon plan for the treatment of elephantiasis The treatment of Dupuytren's contraction, as described, is too complicated and severe, and no mention is made of the necessity for prolonged and careful after treatment Similarly, the method of controlling hæmorrhage after suprapubic prostatectomy by weight extension through the urethra on gauze packed into the prostatic cavity seems unnecessarily severe

Generally speaking, the book is well illustrated, but many of the pictures are unreal and the patients as depicted are all far too good looking In many ways they compare unfavourably with the pictures in the older books where the subjects are clearly sufferers from disease, is, for instance, some of the wonderful drawings from the pencil of Sir Charles Bell ! The nomenclature of many of the methods is unfamiliar, and perhaps this would not strike the reader were it not that liberties are so often taken with old and classical names, as for instance, when the original incision for excision of the upper jaw, always associated with the names of Fergusson and Dieffenbach, is credited to Weber The spelling of proper names is sometimes lax—McEwen in one place, and correctly is Macewen in another, and so on

These, however, are minor criticisms of a good book which gives an interesting account of contemporary American operative surgery

The Surgical Exposure of the Deep seated Blood-vessels By J Fiolle M D , and J Delmas, M D 8vo Pp ix + 87, with 34 original illustrations by H Beaufour Translated and edited by Charles Greene Cumston, B S M , M D (Geneva) With an introduction by Sir D'Arcy Power K B E , F R C S Eng 1921 London William Heinemann (Medical Books) Ltd 8s 6d net

This book is the direct outcome of experience in the war , but, as Sir D'Arcy Power states in the introduction, it will be very useful for reference in those difficult cases which are met with occasionally in the practice of every operating surgeon It describes shortly and clearly the method of exploring arteries wounded in difficult positions, such as the first part of the anterior tibial, where it passes through the interosseous space , the upper part of the popliteal and the lower part of the femoral the vascular trunks of the gluteal region , and the great vessels at the root of the neck The cardinal point upon which the authors lay stress is the free exposure of the vessels by incisions which are often planned upon new lines The reasoning upon which their operations are based appears to be sound, and practice has shown that they are satisfactory Some of the methods recommended need a considerable disturbance of parts, and it is probable that the authors are over sanguine in expecting to obtain union by first intention even in the majority of cases But desperate cases require desperate remedies, and it is only very occasionally that a surgeon in civil practice in a settled country will require to have recourse to them

Professor Greene Cumston has performed his duties as translator and editor with judgment and discretion The translation is smooth and idiomatic, and as the book is designed for the use of surgeons who have been qualified for some years, he has been well advised to use the current anatomical nomenclature

The Surgery of the Peripheral Nerve Injuries in Warfare   By HARRY PLATT, M S   Large 8vo   Pp 49   Paper boards   Illustrated   1921   Bristol   John Wright & Sons Ltd   4s net

THIS book is a record of work well done   Few surgeons in this country have performed five hundred operations for the nerve injuries of warfare, or have had the opportunity afforded by a special hospital of seeing the work of others, or have dealt with such numbers of cases in which operation was unnecessary

The subject is handled in a systematic manner, physiological, anatomical, and pathological considerations being discussed first

In speaking of nerve anastomosis, which he considers has failed to hold its place in operative procedures—an opinion in which the reviewer concurs—the author states that it " has gained adherents as a result of the oft quoted dictum that one third of any mixed nerve can be divided without causing any permanent damage   One feels strongly that this dictum is nothing less than pernicious   It is a complete negation of the existence of any intraneural topography " Sherren, in his book, published in 1908, pointed out the exceptions to this statement, if these are remembered, nerve anastomosis would do no damage to the uninjured nerve used

The clinical considerations are adequate   The method of testing employed was that of Head

The second part deals with operative treatment, and gives the indications for the choice of the particular type of repair   The difficulties in certain cases of obtaining end-to end union are clearly dealt with, and the conclusion at which he arrives is sound   " It is reasonable to emphasize that the recorded success of a small number of operations of the 'bridge' class should not be allowed to influence the surgeon in the direction of relaxing his efforts to obtain end to end suture, no matter how exhausting and tedious any operation may be "

The final section deals with prognosis   His experience bears out that of workers in the South African and other wars, that the time element is not important until after the lapse of two years from injury   He associates this with Kennedy   The two years limit was first mentioned by Bowlby, whose pioneer work on nerve injuries is not even mentioned

The figures illustrating operations on the ulnar nerve are not clear, the surroundings being loaded with forceps   Drawings would have been preferable   There is neither an index nor a list of the chapter headings, omissions which detract from its value as a book of reference   In spite of these minor defects, which can be rectified in another edition, we consider this the most valuable contribution to the war injuries of nerves that has appeared in this country

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Surgical Treatment of Non-malignant Affections of the Stomach   By CHARLES GREENE CUMSTON M D, and GEORGES PATRY, M D, Lecturers at the University of Geneva   With an Introduction by SIR BERKELEY MOYNIHAN, K C M G   C B, F R C S   Demy 8vo   Pp 349   1921   London   Wm Heinemann (Medical Books) Ltd   15s net

IT is difficult to understand why this book has been written   A work produced by a physician and surgeon on the lines set out in the preface might be of very great value   " We shall study successively the operative indications, the results obtained, and the special indications of each procedure "   As a book for the student it fails by naming too many authorities and giving too much space to historical matter   For the surgeon whether skilled in abdominal work or not, the absence of all bibliography renders it useless as a book of reference

There are other important omissions   In the chapter on the etiology of gastric ulcer the important work of Charles Bolton is entirely ignored, and no mention is made of the recent researches of Rosenow   In discussing the operative indications in chronic gastric ulcer a long list of statistics is given with regard to operative mortality, the latest being those of Mayo Robson in 1908   Information of this nature with regard to abdominal surgery thirteen years ago is of historical interest, but is of no value in estimating the death-rate of present day operations   With regard to post operative results, with two exceptions, mentioned later, the latest date given is 1908   The recent figures of the Mayo clinic, Moynihan, and Sherren are not mentioned   The two exceptions referred to are W D Haines, 1918, whose work the reviewer cannot trace, and Troell's report published in 1917 on 234 ulcers of the stomach and duodenum operated on at Stockholm between 1907 and 1914   Information based on figures of this sort is valueless

In the chapter on gastrojejunostomy a long account of the evolution of this operation is given which is of no value to the student, and is useless as history, since no references are given   The writers seem obsessed by the idea of closure of the stoma and state (p 25)   ' These cases of complete occlusion of the stoma are well known to all surgeons at present "   This is not in accordance with experience in this country   Closure does not take place in the absence of gastrojejunal ulceration   Murphy's button is still advised for certain cases   Exclusion of the pylorus is advocated to avoid late recurrence, and the authors express the opinion that ' this will be employed more and more '   The reviewer has had a large experience of the remote results of operation for ulcers of the stomach and duodenum, and has never seen recurrence of the original ulcer or closure of the anastomosis

This book is not one that can be recommended as a guide to the treatment of surgical gastric diseases

Traumatic Surgery By JOHN J MOORHEAD B S , M D , F A C S , late Lt Col Medical Corps, American Expeditionary Force , Professor of Surgery, New York Post graduate Medical School and Hospital Second edition Pp 864, with 619 illustrations 1921 Philadelphia and London W B Saunders Co 45s

IN the preface of this work the author states that " the day has gone by when the hospital care of the injured can be assigned to junior members of the visiting or house staff " This dictum will undoubtedly be supported by progressive surgeons in all countries

The reader will naturally assume that a text book dealing with traumatic surgery will be in essence a work on the treatment of injuries of the locomotor system, and, above all, a monograph on fractures It would seem that such is the author's predilection, but he has found himself compelled to cast his net far and wide, for we find collected into one field of surgery such widely varying conditions as fractures, foreign bodies in the air passages and œsophagus, penetrating injuries of the abdomen, gas poisoning, visceral prolapse, x-ray burns, and the traumatic neuroses But traumatic surgery embracing a field so wide can hardly be said to be a definite entity, and still less a speciality, as claimed by the author The inclusion of so much has necessarily made this work rather uneven, but it is in connection with the chapters on injuries of the bones and joints that it is to be judged In these sections the experiences of the war have been drawn upon freely, and considerable space has been allotted to the technical details of the treatment of infected wounds by the methods of Carrel and others, and to the treatment in general of compound fractures of the femur Such familiar features are to be expected in a work of this kind, and require no special comment

This book, whilst presenting nothing new, will be useful as a work of reference, and particularly to surgeons who are far removed from contact with a large surgical centre

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Lectures on the Surgery of the Stomach and Duodenum By JAMES SHERREN, C B E , F R C S , Surgeon to the London Hospital Cr 8vo Pp 96 1921 London H K Lewis & Co Ltd 4s 6d

IT is seldom that we have the good fortune to read so small a book containing such a wealth of valuable material In the form of seven lectures, the author deals with gastric ulcer, duodenal ulcer, stenosis of the pylorus, and carcinoma of the stomach

Each part of the subject is treated clearly, concisely, and practically There is a sufficient reference to other authorities, and to pathological and other experimental evidence, for the purpose required There are enough case records to give clear illustrations of symptoms and treatment The author does not attach much importance to the value of the test meal in gastric ulcer, and his opinion of a ray evidence is somewhat guarded In the treatment of chronic gastric ulcer it is taught that small free ulcers of the lesser curvature require only gastro enterostomy, whilst for adherent and perforating ulcers, and in those which are large and indurated, partial gastrectomy should be done An interesting observation is made about the treatment of duodenal ulcer— namely, that pyloric exclusion tends to produce subsequent jejunal ulcer following gastro- enterostomy In regard to congenital stenosis of the pylorus, Rammstedt's operation is considered to have superseded all other surgical procedures

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Diagnostik der chirurgischen Nierenkrankheiten By PROFESSOR WILHELM BAETZNER, Privatdozent, Assistent der Chir Universitats Klinik, Berlin 8vo Pp vi + 340, with 263 illustrations, some in colour 1921 Berlin Julius Springer Price in England M 720

THIS book of 340 pages discusses the diagnosis of surgical diseases of the kidney There is a section on general diagnosis and one on diagnosis of special diseases In the general section symptoms and clinical examination are discussed, and there is a description of special methods of diagnosis such as cystoscopy, catheterization of the ureters, tests of the renal function, and pyelography The section on cystoscopy is clear but short, and there are many excellent coloured illustrations of diseased conditions

The tests of the renal function that are discussed are limited to cryoscopy, electrical conduc- tivity of the urine, experimental polyuria, phloridzin, and indigo carmine The tests are treated from a clinical standpoint, without discussion of their scientific value The author appears to have some doubt in regard to the reliability of phloridzin, but indigo carmine is the most important test, and in practice is useful and sensitive These tests, with the exception of indigo carmine, have been abandoned in this country and in America, and it is obvious, from the absence of any reference to the phenolphthalein, diastase blood urea, and urea concentration tests that the author is not in touch with the work which is being done outside Germany

So also with pyelography He uses 10 per cent collargol or 10 per cent pyelon (Riedel), and only mentions that sodium iodide and bromide have been suggested, whereas these are the fluids most widely used outside Germany at the present day The author rightly warns against the indiscriminate use of pyelography

Rautenberg's pneumoperitoneum is mentioned, but the author cannot give a final decision on its value The special diseases of the kidney are all carefully considered, but the discussion

on tubercle is the best   No mention is made of excretory tubercle bacilli in the urine of patients with extra urinary tuberculous foci

The book is carefully written and well illustrated   There are many coloured illustrations, and the reproduction of these touches a high standard of excellence   The book is written for surgeons, urologists, practitioners, and students, but it is too advanced for the two latter classes It should form a useful guide to the surgeon, and contains much that will recommend it to the urologist

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A Treatise on Fractures in General, Industrial and Military Practice   By JOHN B ROBERTS, A M , M D , F A C S , Emeritus Professor of Surgery, and JAMES A KELLY, A M , M D , Associate Professor of Surgery, in the University of Pennsylvania   Second edition, revised and entirely reset   Medium 8vo   Pp x + 755, with 1081 illustrations, radiograms, drawings, and photos   1921   Philadelphia and London   J B Lippincott Company   42s net

IT is hardly necessary to say that this book contains a great wealth of material and illustrations, and for this reason it will always be valuable for purposes of reference   Nevertheless the book as a whole tends in a sense to be disappointing because broad general principles are obscured rather than illustrated by a mass of detail   The preface to the second edition is perhaps the best part of the whole volume, containing is it does a most excellent summary of the principles of treatment   The general principles of treatment of fractures of the long bones are described in four short chapters, but we feel that too much space in the book is occupied by detailed descriptions of splints, bandages, and the anatomy and symptoms of individual fractures, whilst traction, mobilization, and operation as applied to these fractures are inadequately dealt with

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Die ortliche Betaubung (Local Anæsthesia)   By Professor HEINRICH BRAUN, of Zwickau   Pp 508, with 213 illustrations   1921   Leipzig   Ambrosius Barth   M 100

THIS is one of the best dissertations we have read on the subject of 'local anæsthesia'   It is written by a man who has made a thorough study of the subject and who is possessed of sound common sense and good judgement   His enthusiasm for the subject does not obtrude itself unduly, and he gives a very fair indication of the uses and limitations of the application of local anæsthesia Many British and Colonial surgeons have taken the trouble to master the technique of local anæsthesia   Such surgeons use it to an ever increasing extent   Braun quotes figures which show that German surgeons have been compelled, in the interests of their patients, to observe the same course

The directions for the employment of local anæsthesia in operations on the various parts of the body are given with brevity, but are taken in conjunction with excellent illustrations, so clear, that failures should be rare if the technique which the author recommends is carried out in its entirety

EPONYMS

By SIR D'ARCY POWER, K B E, London

IV.—WILLIAM HEY, OF LEEDS.

THE memory of William Hey, of Leeds, (1736–1819) still lingers in surgical literature There are Hey's amputations of the leg and foot, Hey's saw, Hey's ligament, and Hey's hernia   He appears, too, to have been the first to give the name of Gimbernat to the lacunar ligament in the groin   The distance of Leeds from London and from Edinburgh probably prevented Hey from writing in the medical journals of the day , but he tells us that he early began the custom of committing to paper such cases occurring in his practice as seemed rare, or peculiarly instructive   These cases he collected and published under the title of *Practical Observations in Surgery Illustrated with Cases*   The first edition was printed in London in 1803 , the second edition in 1810 , and the third, with a dedication to John Pearson, F R S , in 1814   Pearson lived for three years in Hey's house as a pupil, and afterwards wrote his master's life   The three editions of the *Practical Observations* differ somewhat from one another, and show that Hey maintained an active interest in surgery until the end of his long life

HEY'S AMPUTATION OF THE FOOT

" In the year 1797, a case occurred that led me to a new mode of operating, which, upon repeated trial, has fully answered my expectations, and in the year 1799, I had an opportunity of repeating this operation, and found it to answer perfectly my expectations

" Mary Stansfield, aged eighteen years, of Holme in Lancashire, was admitted an in-patient of the General Infirmary at Leeds, under my care, on account of a caries in the metatarsal bones of one foot, upon whom I operated in the following manner

" I made a mark across the upper part of the foot to point out as exactly as I could the place where the metatarsal bones were joined to those of the tarsus   About half an inch from this mark, nearer the toes, I made a transverse incision through the integuments and muscles covering the metatarsal bones   From each extremity of this wound I made an incision along the inner and outer side of the foot to the toes   I removed all the toes at their junction with the metatarsal bones, and then separated the integuments and muscles, forming the sole of the foot, from the inferior part of the metatarsal bones, keeping the edge of my scalpel as near the bones as I could, that I might both expedite the operation, and preserve as much muscular flesh in the flap as possible   I then separated with the scalpel the four smaller metatarsal bones, at their junction with the tarsus , which was easily effected as the joints lie in a straight line across the foot   The projecting part of the first cuneiform bone, which supports the great toe, I was obliged to divide with a saw   The arteries which required a ligature being tied, I applied the flap, which had formed the sole of the foot, to the integuments which remained on the upper part, and retained them in contact by sutures   A speedy union of the parts took place, and the wound was healed except a very small superficial sore, at the expiration of a fortnight The foot was not so much shortened by this operation as might have been expected   For though the metatarsal bones which had been removed, are usually about three inches in length (I did not measure them in this case), yet the mutilated foot was but one inch

shorter than the sound foot, measuring from the heel to the root of the little toe, the latter being eight inches, and the former seven in length

"The patient could walk with firmness and ease She was in no danger of hurting the cicatrix, by striking the place where the toes had been against any hard substance, for this part was covered with the strong integuments, which had before constituted the sole of the foot The cicatrix was situated upon the upper part of the foot, and had very little breadth, as the divided parts had been kept united after being brought into close contact The advantages of this operation will sufficiently appear upon inspecting the annexed plate (*Fig* 468), in which the mutilated foot is accurately represented from a drawing made by Mr Russell, of the Royal Academy, who happened to be at Leeds before this patient was dismissed from the Infirmary, and who favoured me with two views of the foot, elegantly painted in crayons "

HEY S SAW

Hey appears to take no credit for the saw which is called after him, for he says " If a saw could be contrived, which might be worked with safety in a straight, or gently curvilineal direction, it would be a great acquisition to the practical surgeon Such a saw I can now with confidence recommend, after a trial of twenty years, during which time I have rarely used the trephine in fractures of the skull Its use has been adopted by my colleagues at the General Infirmary in Leeds, and will be adopted, I should hope, by every surgeon who has once made trial of it It was first shewn to me by Mr (now Dr) Cockell, an ingenious practitioner at Pontefract, to whom the public is indebted for the discovery, or revival, of this excellent instrument A saw formed on the same principle is represented in Scultetus s Armamentarium chirurgicum, but I understood Dr Cockell to say, that the instrument which he shewed me was of his own invention, and that he had used it with great advantage in extensive fractures of the skull Dr Cockell s saw had a semicircular edge, as represented in the annexed Plate (*Fig* 469), where the size of the figure is two-thirds of the real dimensions of the instrument But the edge may be made straight (as is shewn in the Plate) or any degree of convexity which may be thought most useful The straight edged saw executes its task with greater readiness, but the convex edge is necessary when the bone is to be sawed in a curvilineal direction It is also useful when the thickness of that part of the cranium which is to be sawed out is very unequal

"This instrument is worked with ease, if the pressure made upon it by the hand is light It saves much time in cases of extensive fracture, where the repeated application of a trephine would have been needful, and it may be used with less danger of wounding the dura mater, if the same precautions are used, in examining from time to time the depth of the groove, as is necessary in the use of the trephine '
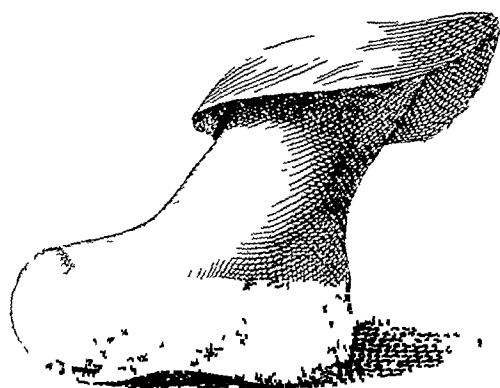
Fig 468 —Hey s amputation of the foot at the tarso metatarsal joints

The saws were made for Mr Hey by Savigny, the well-known instrument maker in London It will be noticed (*Fig* 469) that the saw here recommended has two semi-circular cutting edges   In the later editions of the *Practical Observations,* Hey has
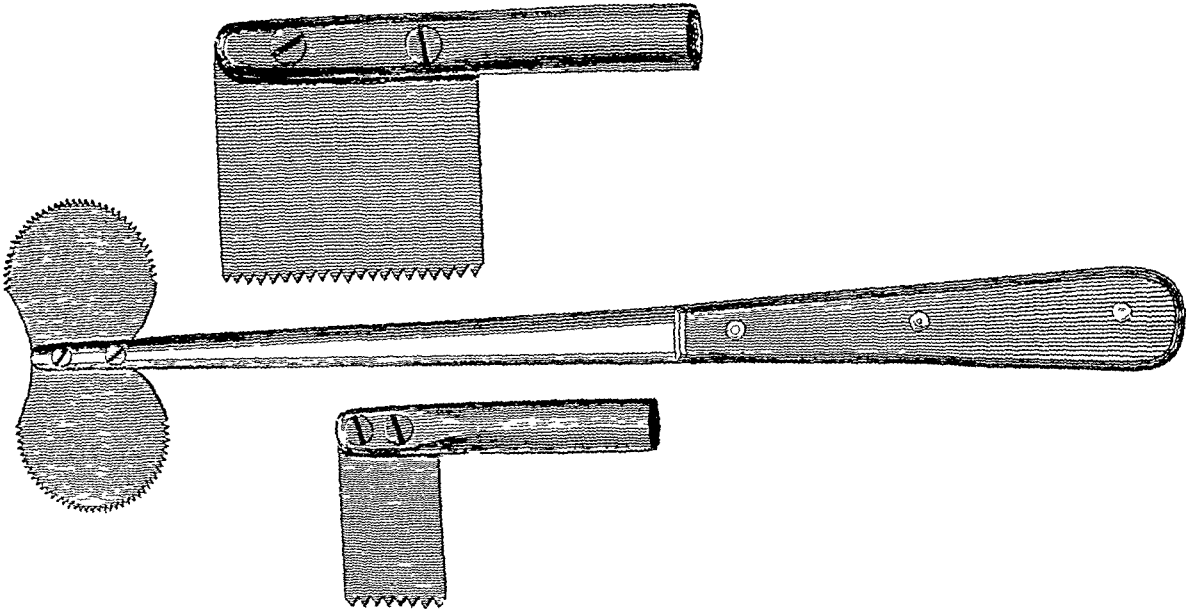
Fig 469 —The first models of Hey's saws

modified it to take its present form of one semicircular and one straight cutting edge which is somewhat convex

HEY'S LIGAMENT

Hey like his contemporaries Astley Cooper and William Lawrence, was much interested in the anatomy of the parts concerned in hernia, and by the advocacy and example of these great surgeons early operation became the routine treatment for strangulation The older treatment was by bleeding, purgative medicines, purging clysters, opiates, the warm bath, the cold bath, the application of cloths dipped in cold water, solutions of crude sal ammoniac ice, ether evaporated on the part, and the injection of tobacco in fume or decoction   Indeed says Hey, " when I first entered upon the profession of surgery, in the year 1759 the operation for the strangulated hernia had not been performed by any of the surgeons in Leeds   My seniors in the profession were very kind in affording me their assistance, or calling me into consultation when such cases occurred , but we considered the operation as the last resource and as improper until the danger appeared imminent By this dilatory mode of practice I lost three patients in five   Having more experience of the urgency of the disease, I made it my custom, when called to a patient who had laboured two or three days under the disease, to wait only about two hours, that I might try the effect of bleeding (if this evacuation was not forbidden by some peculiar circum-stances of the case) and the tobacco clyster   In this mode of practice I lost about two patients in nine upon whom I operated '

In starting out to consider the anatomy of the parts concerned in femoral hernia Hey says ' Don Antonio de Gimbernat, surgeon to the King of Spain, is the only author with whose works I am acquainted who has asserted, that the strangulation in the femoral hernia is not caused by Poupart's ligament   He informs us, that he first demonstrated this in 1768, and afterwards in 1777 explained the subject to the late Dr Hunter, by means of an anatomical preparation   His treatise induced me to examine repeatedly the parts

concerned in the formation of the femoral hernia and to procure drawings of the parts which I had dissected "

' In the femoral hernia the prolapsed parts descend within the aponeurotic sheath which envelopes the *great vessels of the thigh*, and which is strongly attached at its superior part to the ossa pubis The anterior layer of this sheath is formed, in part, by a continuation of the fascia of the abdominal muscles, passing down upon the thigh About three eighths of an inch below Poupart's ligament, there exists in this aponeurotic sheath another ligament, somewhat similar to that of Poupart, but smaller It runs transversely, but does not descend obliquely, as that ligament does On the contrary it rather ascends as it approaches the symphysis of the ossa pubis, passing behind, and decussating, the extremity of Poupart's ligament As I shall have occasion to mention this ligament frequently, I shall, by way of distinction, call it the *femoral ligament*

" This ligament is not situated in the same plane with that of Poupart, but lies deeper, that is, at a greater distance from the integuments "

Mr Hey thought at this time that strangulation in femoral hernia was due to what is now called the superior cornu of the falciform edge of the saphenous opening , but after a visit to London and discussion with Sir Astley Cooper he modified his views, and in the second edition of the *Practical Observations in Surgery* he arrived at the conclusion that the strangulation was due to the structure which " to avoid a disagreeable periphrasis, I shall call Gimbernat's ligament " To settle this point Hey made two visits to London, once in 1805 and again in 1808 " The dissecting room in Windmill Street was open to him at all times by the politeness of Mr Wilson and he received much civility from Sir Everard Home, Mr Abernethy and others," says Pearson in his life of Hey, " but he deemed himself under particular obligations to the attentions of Mr Astley Cooper This gentleman showed him the anatomical preparations he had made, which tended to illustrate the object of Mr Hey's inquiries , he discussed with great openess and candour the several points upon which Mr Hey had doubts, or desired further information, and he dissected a recent subject in his private dissecting room, in Mr Hey's presence, for the express purpose of demonstrating to that gentleman the parts concerned in the formation of femoral hernia During Mr Hev's very short stay in London in 1808, he demonstrated upon a recent subject in the anatomical theatre in Windmill Street, the parts concerned in the femoral hernia according to his own conceptions of them, before a numerous and most respectable assembly of the anatomists and surgeons resident in the metropolis His explanations were perspicuous and satisfactory but the time and attention which he employed in these researches in the dissecting room at his advanced period of life, [æt 72] had a most unfriendly influence upon his health He became seriously ill on his journey to Leeds and many months elapsed before he was capable of resuming his accustomed occupations "

The Great Windmill Street School of Medicine was opened by Dr William Hunter in 1768, and after his death was carried on by Cruikshank and Mathew Baillie, who in turn were succeeded by James Wilson Benjamin Brodie, who had acted as demonstrator in the school, began to lecture on surgery there in 1808, the year of Hey s second visit

HEY S HERNIA

' An account of a new species of Scrotal Hernia November 6th, 1764 I examined the body of a child, fifteen months old, who had died of a *strangulated scrotal hernia*, in the presence of Dr Crowther, a physician who then lived at Leeds Having examined the contents of the abdomen without altering the state of the hernia, I made a longitudinal division of the scrotum on its right side, continuing my incision the whole length of the tumour, and laid bare, as I imagined, the hernial sac This I opened towards its inferior part, which was the most prominent , but it proved to be the *tunica vaginalis testis*, containing, together with the testicle, a portion of the true hernial sac

" This unusual appearance engaged me to prosecute the dissection with great care

I found that the tunica vaginalis was continued up to the abdominal ring, and inclosed the hernial sac, adhering to that sac by a loose cellular substance, from the ring to within half an inch of its inferior extremity   The fibres of the cremaster muscle were evident upon the outside of the exterior sac, or tunica vaginalis   The interior or true hernial sac was a production of the peritoneum as usual, and contained only the cæcum or head of the colon   Having removed the proper hernial sac   I examined the posterior part of the exterior sac, and found it connected with the spermatic vessels in the same manner as the *tunica vaginalis* is, when the testis has descended into the scrotum   An additional proof, that the exterior sac was the *tunica vaginalis*

" From all these circumstances it is evident, that this hernia differed both from the common scrotal rupture, in which the hernial sac lies on the outside of the tunica vaginalis , and also from the *hernia congenita*, where the prolapsed part comes into contact with the testicle, having no other hernial sac besides the tunica vaginalis "

Hey then proceeds to consider the manner in which the tunica vaginalis is developed and the way in which it closes, arriving at the conclusion that " This kind of scrotal hernia may not improperly be called *hernia infantilis*,* as it can only exist when the rupture is formed whilst the parts retain the state peculiar to early infancy '

HEY S INTERNAL DERANGEMENT OF THE KNEE-JOINT

The name of Hey is undoubtedly best remembered in connection with the short chapter on " Internal Derangement of the Knee Joint ", a condition which he clearly distinguished from ' loose Cartilaginous Substances in the Joints ', although he had no opportunity of examining a knee to determine the exact nature of the injury   He says, after a few preliminary remarks —

" This joint is not unfrequently affected with an internal derangement of its component parts , and that sometimes in consequence of trifling accidents   The disease is, indeed, now and then removed, as suddenly as it is produced, by the natural motions of the joint without surgical assistance   but it may remain for weeks or months, and will then become a serious misfortune, as it causes a considerable degree of lameness   I am not acquainted with any author who has described either the disease or the remedy , I shall, therefore, give such a description as my own experience has furnished me with, and such as will suffice to distinguish a complaint, which, when recent, admits of an easy method of cure

" This disorder may happen either with, or without, contusion   In the latter case it is readily distinguished   In the former, the symptoms are equivocal, till the effects of the contusion are removed   When no contusion has happened, or the effects of it are removed, the joint, with respect to its shape, appears to be uninjured   If there is any difference from its usual appearance, it is, that the ligament of the patella appears rather more relaxed than in the sound limb   The leg is regularly bent or extended by the hands of the surgeon, and without pain to the patient , at most, the degree of uneasiness caused by this flexion and extension is trifling   But the patient himself cannot freely bend, nor perfectly extend the limb in walking , but is compelled to walk with an invariable and small degree of flexion   Though the patient is obliged to keep the leg thus stiff in walking , yet in sitting down the affected joint will move like the other

' The complaint which I have described may be brought on, I apprehend, by any such alteration in the state of the joint, as will prevent the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages and articular depressions of the tibia   An unequal tension of the lateral, or cross ligaments of the joint, or some slight derangement of the semilunar cartilages, may probably be sufficient to bring on the complaint   When the disorder is the effect of contusion, it is most likely that the lateral

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* It is worthy of notice that the paper by Mr Hamilton Russell in the present issue of the JOURNAL deals with the subject of Hey s infantile hernia   He calls it encysted hernia and offers interesting explanations of the condition

ligament on one side of the joint may be rendered somewhat more rigid than usual, and hereby prevent that equable motion of the condyles of the os femoris, which is necessary for walking with firmness   The method of cure, which I am about to propose, must not be used while there is any inflammatory affection, or swelling of the joint , but only when these effects of contusion are removed ''

Mr Hey then proceeds to give details of five instances occurring in four patients Of these the second case is the best for purposes of illustration —

" In 1784 the honourable Miss Harriet Ingram (now Mrs Aston), as she was playing with a child, and making a considerable exertion, in stretching herself forwards, and stooping to take hold of the child, while she rested upon one leg, brought on an immediate lameness in the knee joint of that leg on which she stood   The disorder was considered as a simple sprain , and a plaster was applied round the joint   As the lameness did not diminish in the course of five or six days, I was desired to visit her

" Upon comparing the knees, I could perceive no difference, except that, when the limbs were placed in a state of complete extension, the ligament of the patella of the injured joint seemed to be rather more relaxed than in that joint which had received no injury When I moved the affected knee by a gentle flexion and extension, my patient complained of no pain , yet she could not perfectly extend the leg in walking, nor bend it in raising the foot from the floor   but moved as if the joint had been stiff, limping very much, and walking with pain

" I thought it probable, that the sudden exertion might in some degree have altered the situation of the cross ligaments, or otherwise have displaced the condyles of the os femoris with respect to the semilunar cartilages , so that the condyles might meet with some resistance when the flexor or extensor muscles were put into action, and thereby the free motion of the joint might be hindered, when the incumbent weight of the body pressed the thigh bone closely against the tibia , and though this derangement was not so great as to prevent the joint, when relaxed, from being moved with ease

" To remedy this derangement, I placed my patient upon an elevated seat, which had nothing underneath it that could prevent the leg from being pushed backward towards the posterior part of the thigh   I then extended the joint by the assistance of one hand placed just above the knee, while with the other hand I grasped the leg   During the continuance of the extension I suddenly moved the leg backwards, that it might make as acute an angle with the thigh as possible   This operation I repeated once, and then desired the young lady to try how she could walk   Whatever may be thought of my theory, my practice proved successful , for she was immediately able to walk without lameness, and on the third day after reduction she danced at a private ball without incon-venience, or receiving any injury from the exercise   In October, 1786 the young lady had the misfortune to produce the same injury in her knee, in rising hastily out of bed After the lameness had continued about a week, without any amendment, I was consulted The method of cure above described was made use of, with the same immediate success ''

PNEUMOCOCCAL PERITONITIS

By J E McCARTNEY and JOHN FRASER, Edinburgh

Among the acute abdominal emergencies of childhood, pneumococcal peritonitis ranks as one of the most serious, as one which is associated with perhaps the highest scale of mortality Its occurrence is not confined to children, but the proportional incidence is so vastly greater in the child than in the adult that it has come to be looked upon as a disease of childhood and youth

Even in childhood it cannot be described as a common disease It is impossible to give figures by which to form an estimate of its proportional occurrence, but probably about 2 per cent of the abdominal emergencies of childhood are due to abdominal pneumococcal infection In this connection, however, it must be noted that a proportion of pneumococcal peritoneal infections are not diagnosed as such, and the occurrence of the condition is more common than we realize Evidence which may be said to support this assertion is afforded by statistics showing the admission figures of the disease during the years 1902, 1911, and 1920—the admissions were 4, 7, and 15 respectively The probability is that, while the actual proportional occurrence has remained constant, the class of case is now more efficiently recognized and is submitted to surgical interference at an earlier period

For certain reasons a study of the disease is attractive Its mortality is so high that any additional knowledge which will tend to reduce that mortality must be welcome, the apparently idiopathic nature of the affection in certain cases stimulates investigation, and there are a number of clinical points which arise in connection with the disease and which are of interest from the symptomatic point of view

An investigation has been made, therefore, of a series of 56 cases which have come under treatment at the Children's Hospital, Edinburgh In this institution the age limit is fixed from birth to twelve years and therefore the cases have all fallen within this period

CLINICAL FEATURES OF THE DISEASE

It is rational and convenient to introduce the subject with a consideration of the clinical features which characterize the disease A systematic study of the case-histories suggests their division into two main groups (A) *Primary Cases—Acute and Chronic* (B) *Secondary Cases*

In *Group A* it is understood that the peritoneal inflammation is the original manifestation of the disease, and in *Group B* the peritonitis is a secondary development, there being a previous pneumococcal infection in some other portion of the body (e g , the lungs, pleura, etc) In *Group A* a further subdivision is necessary Clinically we observe two varieties of the primary pneumococcal infection—an acute and a chronic according to the intensity and progress of the disease *Group B* requires no subdivision as the features associated with it follow a uniform course, generally subacute in character

Typical Clinical Histories of the Disease —Adopting therefore the above classification, we give the clinical histories of three cases, each of which may be regarded as typical of a different variety of the disease

Case 1 —Example of an acute primary pneumococcal peritonitis

A female child age 6 years was admitted to hospital on account of severe abdominal pain persistent vomiting, and general prostration The duration of the illness before admission only extended over twenty four hours In the morning the child had appeared to be in excellent health, and partook of a hearty breakfast At 10 a m , while playing with her companion

she suddenly complained of severe abdominal pain, and half an hour later she was violently sick   She was put to bed, and throughout the day the pain continued, while the vomiting was persistent   During the night these features continued, but she made very little complaint, and in the morning her condition was one of collapse, with intervals of complete unconsciousness

In this condition she was admitted to hospital   On admission she was unconscious—there was slight general cyanosis, temperature was 103°, the pulse uncountable, and the respiration-rate 50   The abdomen was rigid in its lower half, below the umbilical plane the percussion note was dull   On account of the loss of consciousness it was difficult to estimate the question of pain, but there appeared to be tenderness in both iliac fossæ

Operation revealed an intense peritonitis, most marked in the lower abdomen   From the exudate pneumococci were isolated

Within thirty-six hours of the onset of the illness the child succumbed   The case throughout presented the most intense features

Case 2 —Example of a chronic primary pneumococcal peritonitis

A female child, age 10 years   The illness extended over a period of three weeks before admission to hospital   Its onset was marked by colic like pains in the lower abdomen, followed in a short time by profuse diarrhœa and intermittent attacks of vomiting   During the first week of the illness the trio of symptoms continued, but that they were not of extreme urgency may be inferred from the fact that during this time the child was not entirely confined to bed   During the second week of the illness the symptoms continued, the pain was still a prominent feature, but the diarrhœa and vomiting became less marked   During this week bodily weakness became noticeable, and there was considerable loss of flesh   She was now confined to bed   With the commencement of the third week the diarrhœa abated, and a new feature made its appearance in the shape of a tender swelling in the lower abdomen   At this time frequency of micturition and pain on micturition appeared, while there were recurrent attacks of colic

The child was admitted to hospital exactly three weeks after the onset   A summary of her condition on admission may be expressed as follows   A pale emaciated girl   Her general appearance was one of extreme nervous irritability   The mouth and lips were dry, the temperature was 102°, and the pulse rate 120   Abdominal examination showed a rounded tender swelling extending in the middle line to the level of the umbilicus and filling the pelvis   There was a leucocytosis of 20,000, and a well marked glycogenic reaction   Laparotomy showed the presence of an encysted abscess in the pelvis and lower abdomen   its contents were in keeping with a pneumococcal infection and pneumococci were isolated from the exudate

The outstanding features of Case 2 were   The long-drawn-out history—three weeks The chronicity of the disease from its commencement, as evidenced by the fact that during the first week of the illness the child was only confined to bed at intervals   The gradual formation of an encysted abdomino-pelvic abscess

Case 3 —Example of a secondary pneumococcal peritonitis

A male child, age 1 year and 8 months   Four weeks before admission the patient had an attack of bronchitis which eventually developed into pneumonia   After a period of grave illness the child, at the end of three weeks, appeared to be well on his way to recovery   For three days he had been able to be carried out of doors, and his condition was eminently satisfactory, when he began to complain of pain which he referred to the left upper quadrant of the abdomen Fever returned, general malaise developed, and there was vomiting   Jaundice formed an item in the case

When the child came under observation in hospital he displayed the features associated with a localized peritonitis   The abdominal rigidity was most marked on the left side, and the various evidences of inflammation were more pronounced in the upper than in the lower abdomen

Laparotomy showed a subacute pneumococcal peritonitis   the evidences of the infection were chiefly in the upper left quadrant of the abdomen

It is but natural that greater interest should attach to an investigation of the primary than to the secondary type, because in the former we have the stimulus of attempting to explain the apparently spontaneous involvement of the peritoneum by the pneumococcus   Therefore the following remarks are concerned entirely with the *primary type*

A   THE 'PRIMARY VARIETY, ACUTE AND CHRONIC

Recognizing then such different varieties of the disease, each with its characteristic history, the object of this contribution is to discuss certain aspects of the primary type of pneumococcal peritonitis—the type which in literature is sometimes spoken of as the

'idiopathic variety The term 'idiopathic , when applied to pneumococcal peritonitis, has been used to convey the impression that, while the exciting cause was an infection of the peritoneum by the pneumococcus, no visceral lesions were apparent as the source from which the infection arose , in contradistinction for example, to the peritonitis secondary to appendicular infection

The various aspects of the disease which we propose to discuss are (1) *The mode of infection* , (2) *Clinical peculiarities of the disease* , (3) *Modern methods of treatment*

1 THE MODE OF INFECTION

With regard to the mode of infection of the peritoneum in primary cases, the organism might conceivably reach the peritoneal cavity in several ways, namely (a) By the blood-stream , (b) By the intestinal tract through the gastro-intestinal mucous membrane , (c) By direct extension from the throat by the lymphatics from the mediastinum , (d) Through the Fallopian tubes from the vagina in the female Let us summarize the evidence which exists for or against each of these various possibilities

a **By the Blood-Stream** —Rischbieth, in a comprehensive paper published in 1910 put forward strong claims in support of the view that primary pneumococcal peritonitis was in reality a secondary peritonitis, being secondary to a generalized blood infection He states " Pneumococcal peritonitis is always secondary, not to a single focus of disease, but to a septicæmia The view that the condition is secondary to pneumococcal septicæmia is the only one which explains all cases "

There are, however, certain strong objections to the adoption of the theory of the hæmic infection, and Rischbieth's paper has failed to controvert them

In support of his view, Rischbieth asserts that pneumonia has a hæmatogenic origin, being produced by organisms conveyed to the lung in the blood-stream This contention is apparently founded on the fact that the pneumococcus was shown to be present in the blood at the time of onset of clinical symptoms of pneumonia, or, in occasional instances, before the clinical symptoms of pneumonia had appeared In point of fact, however, pneumococci can be obtained from the blood in practically every case of pneumonia The hæmatogenic view of the cause of pneumonia has been definitely disproved by the recent work of Blake and Cecil These observers showed that it was only by intratracheal injection of pneumococci that pneumonia could be produced in monkeys, and that a quantity as small as a millionth of a cubic centimetre of a broth culture was sufficient always to induce a severe or fatal case of the disease Under these conditions it was found that organisms appeared in the blood-stream within six to twenty-four hours after injection, frequently before clinical evidence of pneumonia or elevation of temperature had developed Moreover, Blake and Cecil showed that by intravenous injection of pneumococci a fatal septicæmia was produced, and in no case did either pneumonia or peritonitis occur These experiments of Blake and Cecil have an important bearing on the subject under discussion, as we believe that an analogous condition occurs in peritoneal infection

As pneumococci gain access to the blood-stream in practically every case of pneumonia, one would expect that pneumococcal peritonitis would be a very common complication of pneumonia if Rischbieth's view were correct Actually, peritonitis is a rare sequel to pneumonia Rolleston's figures are 11 cases of peritonitis in 4454 cases of pneumonia or 0 24 per cent Surely there would be a bigger percentage than this if peritonitis were caused by blood infection Moreover, in these 11 cases the probability is that there were some where the infection was conveyed from the pleura through the diaphragm by lymphatics to the peritoneum, which would still further reduce the percentage of cases which could have been due to the organisms being carried in the blood

The last point of evidence in opposition to the hæmic infection arises in regard to the morbid anatomy of the disease It is alluded to more fully later , but at this stage it may be stated that clinical, pathological and bacteriological evidence is in favour of the disease beginning as a pelvic peritonitis If this observation is correct (and we possess

strong evidence in its favour), it is difficult to understand why a septicæmia should pick out a localized portion of the peritoneum for an inflammatory reaction, and, moreover, one of the most resistant portions of the peritoneum

These are strong objections to the theory of hæmic infection

b **By the Gastro-intestinal Tract**.—It has been suggested that the infection passes through the wall of the intestinal tract and so induces a peritoneal infection   This view has been based on the demonstration of two features—the occurrence of pneumococci in the intestinal flora, and the presence of the organism in pneumococcal peritonitis in the subperitoneal tissues of the intestinal wall (Stoos)   Both observations are undoubtedly correct, but neither justifies the adoption of the view that the gastro-intestinal tract is the avenue of infection   In regard to the first, the pneumococcus is frequently a resident among the intestinal flora, but its occurrence is never a common one   The second feature —the demonstration of the pneumococcus in the intestinal wall in cases of pneumococcal peritonitis—is most likely an example of an invasion of the wall from the peritoneal surface   its occurrence in the wall apart from an overlying peritoneal infection has never been demonstrated

Two other facts tend to contradict the intestinal theory   If infection occurred from the mucous surface outwards it is practically necessary to assume that a mucous lesion pre-existed, which permitted of the invasion of the wall   Careful investigation of a number of cases of pneumococcal peritonitis under our care has failed to demonstrate the occurrence of any lesion of the intestinal mucosa   Finally, Jensen investigated the theory from an experimental aspect   He fed rabbits with virulent cultures of pneumococci, and in one instance caused peritonitis , but he himself states that it was a terminal infection, and occurred late in the disease, and was a result of direct extension through the very inflamed gut wall

We have repeated Jensen s experiments on an extended scale, but up to the present we have completely failed to produce peritonitis   Young rabbits were fed with as much as 10 c c of a broth culture of virulent pneumococci of which 0 001 c c was sufficient to cause death in twenty-four hours when injected subcutaneously   Others were fed with sodium bicarbonate and with sodium bicarbonate and tincture of opium (to neutralize gastric juice and slow intestinal movements) before administration of pneumococcal cultures   All the animals remained perfectly healthy

We possess therefore, no direct evidence in favour of the gastro-intestinal route of infection

c **By the Lymphatic Route**.—The possibility has to be considered that the infection may have passed into the lymphatic stream through the tonsillar, pharyngeal, or bronchial glands, and, passing thence to the subperitoneal lymphatics, may be responsible for a generalized peritoneal infection   It seems unnecessary to adopt such an unlikely possibility when more obvious routes exist, but the question must be considered   If we accept the lymphatic theory of infection we must believe that a massive lymphatic infection occurs such as has no parallel in pathology   Further, we must recognize that the infection extends in a direction contrary to the normal lymph flow   These are two possibilities which no evidence supports, and in the absence of it, they very naturally cannot be accepted

d **By the Genital Tract in the Female**.—The peritoneal cavity of the female possesses one characteristic which distinguishes it very sharply from that of the male—it is in communication with the exterior through the medium of the genital tract   Such a characteristic naturally suggests that this channel may be the medium through which infection enters the peritoneal cavity   The importance of the genital channel as a possible route of infection is becoming increasingly evident   It is recognized that a gonococcal peritoneal infection occurs in this way, and Milcher has recently produced strong evidence that some cases of tuberculous peritonitis in the female owe their development to a genital infection   In a group of 14 cases which he examined with remarkable thoroughness he was able to demonstrate conclusively that 12 of them owed their origin to infection which had extended from the internal reproductive organs

But, if the argument is to be considered in connection with pneumococcal peritonitis, one basal fact must first be established, for upon it the whole question necessarily depends

Is Primary Pneumococcal Peritonitis peculiar to the Female ?—We believe that a positive answer is the correct one to such a question   Before we state our reasons for giving such an answer, the importance of the term 'primary' must be insisted on   By the use of this adjective we mean that variety of pneumococcal peritonitis in which no demonstrable lesion can be found in any other part of the body, such as the lungs, pleura, or joints   Peritonitis in association with these we would speak of as secondary, and of course we recognize that the term 'primary' is never strictly correct   but we employ it in this connection in contradistinction to the variety which is obviously a secondary development   With this explanation we believe that primary pneumococcal peritonitis is a disease peculiar to the female sex

In a study of 56 cases we have never found an example of the primary variety occurring in the male   In the total series which we have under review, 12 boys were affected and 44 girls   We have taken the utmost care in the investigation of the cases and it has been our experience that in each of the 12 male cases the peritonitis was a secondary development   The accompanying table shows in greater detail the elaboration of this point —

PNEUMOCOCCAL PERITONITIS IN 12 MALE CASES

CASE No	CASE RECORD
4	Right lobar pneumonia under treatment before peritonitis apparent
8	Two previous attacks of pneumonia a third attack preceded the peritonitis
11	Lobar pneumonia preceded the peritonitis
12	Right lobar pneumonia preceded the peritonitis
13	Empyema preceded the peritonitis
18	Lobar pneumonia preceded the peritonitis
28	,, ,
33	, ,
37	,, ,
39	
41	,
50	,,

It is of interest, though it does not strictly concern us at this point, that the development of the peritonitis was in the great majority of cases secondary to a lobar pneumonia (10 cases) is opposed to a bronchopneumonia (1 case),   further   that a right-sided pneumonia was the most common situation of the disease

Of the 44 cases which occurred in girls, 8 were examples of secondary peritonitis that is to say, there was a preceding pneumococcal chest infection

There remains therefore a group of 36 cases which we regard as examples of primary pneumococcal peritonitis, and these without exception developed in girls   Thus, at this stage is far as our clinical experience goes the evidence is entirely in favour of primary pneumococcal peritonitis being confined to girls

The next point for consideration is—What are the evidences which exist in support of the view that the infection occurs along the female genital tract ?

Evidence in Support of the View that Primary Pneumococcal Peritonitis arises as the Result of Infection along the Genital Tract—The evidence available is wide and divergent, and of course it is additional proof that the primary infection only exists in the female sex

It is Mainly a Disease of the Poorer Classes of Society—This observation has been made repeatedly   Men of long surgical experience have recorded that they have never seen in example of primary pneumococcal peritonitis in private practice   Other pneumococcal infections do not possess this peculiarity—both pulmonary and non-pulmonary manifestations are only slightly more common among the poor than among the well-

to-do It is the dirty, neglected, unhygienic child who contracts primary pneumococcal peritonitis owing to imperfect genital hygiene, a direct contamination of the parts, and close association with other children

We had noticed on examining numerous vaginal smears from young children for gonococci, etc, that sometimes large numbers of organisms resembling pneumococci were present On making cultural investigations from young girls, we found that it was possible to isolate pneumococci from a number of cases, and moreover, on inoculating mice, some of these strains were pathogenic It was, however, only from the neglected dirty children of the lowest classes that pneumococci were obtained We failed to isolate the organism from better-class patients

Thus it is seen that pathogenic pneumococci may be found at the entrance of the female genital tract

Bacteriological Evidence in favour of the Genital Tract —In the last 10 cases of acute primary pneumococcal peritonitis operated upon at the Children's Hospital, swabs were taken from the lower and upper regions of the peritoneal cavity, from the vagina, and from the throat Blood cultures were also made Pneumococci cultivated from the above sources were typed with Rockefeller type sera In all cases the examination (by film preparations and culture) of the swabs taken from the peritoneal cavity showed evidence of a much heavier infection in the pelvis than in the upper abdomen Actually, in one early case, we failed to find organisms in the upper part of the abdomen, but easily demonstrated pneumococci in exudate from the pouch of Douglas

In every case pneumococci were isolated from the vaginal swab, and the blood culture always showed an abundant growth of pneumococci In each individual the organisms isolated from the abdomen, vagina, and blood-stream were all of the same type

In 1 case the pneumococci isolated from the abdomen, vagina, and blood-stream were all of Type I, whereas pneumococci obtained from the throat belonged to Type IV In 8 cases the infection was due to a Type I pneumococcus, and in 2 cases to a Type II pneumococcus This is of interest, as infections due to Type II pneumococcus are rare in children

These bacteriological observations furnish evidence entirely in favour of the theory of infection by the genital tract —

i The isolation of the same type of organism from the blood, vagina, and peritoneal cavity

ii In one case the pneumococcus isolated from the throat was of a different type from the organism causing the infection

iii The isolation of pneumococci from the vagina, blood, and pelvis, while it was not possible to demonstrate the organism in the upper portion of the peritoneal cavity

We attach considerable importance to the last observation, as demonstrating that the infection is at first localized to the pelvic peritoneum, instead of being general from the beginning, as some observers have stated

Another point of interest is that pneumococci can be isolated from the blood stream even in the very early cases It is on this phenomenon that several writers have based their theory of the hæmic origin of the infection As a matter of fact, organisms reach the blood stream from the peritoneal cavity in a very short space of time Jensen first showed that pneumococci could be demonstrated in the blood-stream of a rabbit a few minutes after intraperitoneal injection of a virulent culture In a series of similar experiments we were able to demonstrate pneumococci in blood from the ear vein of a rabbit four minutes after intraperitoneal injection of pneumococci One would expect, therefore, to find organisms in the blood-stream in early cases

C J Bond, in his experiments, demonstrated the presence of an ascending mucous current in the genital tract, and he showed that the introduction of colouring matter into the vagina led to its eventual distribution over that portion of the parietal peritoneum with which the fimbriæ of the tubes are in contact An obvious channel therefore exists for the passage of a pneumococcal infection from the vagina to the pelvic peritoneum

The Age Incidence of the Disease —If we examine in detail the age incidence of the cases of primary pneumococcal peritonitis, an interesting fact is brought out, and one which has considerable significance in its relationship to the etiology of the disease   If we divide the age period up to the twelfth year of life into five different groups—to the end of the first year, from one year to three years, from three years to seven years, from seven years to nine years, and from nine years to twelve years—and if now upon this scheme we plot out the relative occurrence of the disease, the table below appears —

The remarkable feature is the preponderance of the disease during the period from the third to the seventh year, and in a more detailed analysis we find that it is the fifth and sixth years which show the most frequent occurrence One naturally seeks for an explanation of such a distinctive incidence, and there are two points with an anatomical bearing which possibly may play a part in the explanation

The first is in relation to the patency of the female vagina   At birth the walls of the vagina are in close contact, and the epithelial separation may actually be incomplete , it may be only after the third year that free separation is fully established   This anatomical point may therefore to some extent afford a key to the solution, because an ascending infection is most likely to occur after the separation has become complete

The second point is in relation to the reaction of the vaginal secretion   Up to a period between the seventh and eighth years of life the vaginal secretion of the child is alkaline in reaction , after that period it becomes acid It has been suggested that during the period of the alkaline reaction the tendency to infection is greater than it is at a later stage

A = up to 1 year
B = 1 year to 3 years
C = 3 years to 7 years
D = 7 years to 9 years
E = 9 years to 12 years

Clinical Evidence in Favour of the Infection beginning as a Pelvic Peritonitis — Though we propose later to detail the clinical features of the disease, we may summarize at this stage certain evidences which point to the fact that the primary type of pneumococcal peritonitis begins as a pelvic infection

There are certain symptomatic evidences   In early cases the pain is referred to the suprapubic region   Pain on micturition and frequency of micturition are features frequently described   There is the diarrhœa which so often forms a distinctive symptom in pneumococcal peritonitis , we believe that it is due to an irritation of the pelvic colon and the lower coils of the ileum, and it is an evidence of a pelvic peritonitis just as it is an indication of pelvic peritonitis in the abscess complication which develops secondary to appendicitis

Operation reveals certain facts which afford evidence in favour of infection by way of the genital tract   We believe in the efficacy of early operation and therefore we have had repeated opportunities of observing the degree and distribution of the infection in the early stages of the disease   Our experience has uniformly been that in the early stages of the condition the infection is purely one of the pelvic peritoneum , and further it is localized in its earliest beginnings to the peritoneum which lies in the neighbourhood of the Fallopian orifices

Conclusion Regarding the Mode of Infection

We believe that where the primary variety of pneumococcal infection is concerned the disease is confined to the female sex   and this peculiarity is explained by the fact that the infection is a direct one through the genital tract   The evidence which we possess is in favour of this conclusion

2   CLINICAL PECULIARITIES OF PRIMARY PNEUMOCOCCAL PERITONITIS

In any consideration of the clinical features it has to be recognized that there are two types of the primary disease, and that these two types are as widely apart in the acuity of symptoms as it is possible to be   One variety of the acute type may constitute the most sudden abdominal emergency, with death soon after twenty-four hours (*Case* 1) On the other hand, the disease may be so chronic in its character as to lead to its confusion with such a condition as tuberculous peritonitis (*Case* 2)   It probably would afford a more satisfactory classification to recognize three varieties of the primary disease —fulminating, acute, and chronic   It is to be supposed that variations in the infecting organism are responsible for the divergence of the clinical features

The clinical peculiarities of the disease are best seen and studied in a moderately acute case, one in which the special points of the disease are not masked on the one hand by the extreme toxicity of the infection or on the other by the mildness of the disease

Sequence of Events in a Typical Case —In such a case the clinician will be able to recognize that the disease runs through a definite sequence of events   There is the intro ductory period during which the infection is localized, and we believe localized at first to the pelvic peritoneum   About the third day (sometimes earlier, sometimes later, depending on the acuteness of the infection) the disease enters on its second stage, the stage of general infection of the blood-stream—the stage of septicæmia   This is the critical period of the disease   Symptomatically it can be recognized by what is often a dramatic change in the clinical picture—restlessness, cyanosis quickened respiration, exaggerated action of the alæ nasi, delirium, hyperpyrexia, and increased rapidity of the pulse-rate

A certain number of cases may never enter upon this stage , they are the more chronic types, which remain encysted and localized from the beginning , but if this stage is definitely entered on, the prognosis instantly becomes one of extreme gravity, and in a considerable proportion of the cases the disease will proceed to a fatal termination

The subdivision of the clinical history into introductory and septicæmic stages is important from the prognostic and diagnostic points of view, and also as we shall endeavour to show, from the point of view of treatment

Individual Peculiarities of the Disease —Apart from the two more general charac teristics of the type of the disease and the sequence of its events, there are certain local manifestations which give the disease a distinctive character   One of the most striking of these is the excessive vomiting during the early acute stage , it is sometimes so intense that it has been suggested it is the result of the action of the pneumococcal poison on the central nervous system , it is certainly very different from the reflex vomiting of an appendicular infection, and it appears too early in the case-history to be obstructive in its origin

Diarrhœa is the second feature which we would describe as characteristic of the disease   Of the 36 cases of primary peritonitis with which the series is concerned, in 32 there was a history of diarrhœa in the early stages   The 4 exceptions were all examples of the fulminating type

It is interesting to notice that among males, whom we believe to be subject only to the secondary variety of the disease there were no examples of the diarrhœic symptom Such a sex distinction is important in view of our thesis regarding the etiology   In certain instances the diarrhœa was accompanied by rectal tenesmus and the passage of blood-stained mucus   This symptom is a strong evidence of a pelvic peritonitis, as it is the result of an irritation of the terminal portion of the ileum and the pelvic colon

A third distinctive group of symptoms are those associated with the bladder— frequency of micturition, and pain on micturition   Their recognition is valuable in so far as they add yet another feature to the group of symptoms which point to pelvic irritation in the early stages of the disease

The last point to which we would draw attention (and it is one to which we have alluded already) is the change in clinical features coincident with the stage of septicæmia

The abdominal aspects of the case become masked by the acute general signs and symptoms of a pneumococcal septicæmia

Pathological Changes—We do not propose to enter into a detailed account of the pathological changes—only points of special interest or application are alluded to

Operation Findings—At operation in the early cases the only lesion to be seen is a film of exudate, which is of an oily or sticky character, over the pelvic viscera   This exudate has at first a tendency to cause the adhesion of peritoneal surfaces, this tendency, however, disappears as the effusion becomes more fluid

After twenty-four hours have elapsed, the exudate becomes watery and profuse, of a brownish colour, with flakes of lymph and fibrin   It is only during and after the fourth day that the exudate becomes definitely purulent   This evidence of a delay in leucocyte migration is an indication of the intensity of the disease, and, from the point of view of prognosis we pay considerable attention to the character of the effusions, for we believe undue delay in the appearance of purulency is an unfavourable aspect in the prognosis

The peritoneum is of a plum-coloured and congested appearance   The small intestine is distended   The Fallopian tubes were carefully examined   The fimbriæ are congested, and on several occasions we have been able at operation to expel mucopurulent material from the interior of the tubes   The chlorides in the urine from these cases were estimated, and in a few cases estimations of blood chlorides were carried out   The urine showed a reduction of chlorides   Blood chlorides were reduced in amount   Even in the early cases there is definite leucocytosis   and when the condition reaches the septicæmic stage we have been able to demonstrate an increase of the H ion content of the plasma

Post-mortem Findings—At all post-mortem examinations careful search was made for other foci of pneumococcal infection, but none was found   In the last series of cases the middle ear was particularly examined, but with negative results

The Fallopian tubes in all cases were congested, and on section a catarrhal inflammation was present   Pneumococci were invariably demonstrated in the tubal secretion   The solid viscera showed the usual toxic changes

3   SOME ASPECTS OF THE TREATMENT OF THE DISEASE

Rischbieth in the paper which we have already quoted, takes a pessimistic view of the mortality of the disease and there is justification for his pessimism when he recounts that the total mortality averages 88 8 per cent in the collected statistics from the London hospitals   He has apparently been so impressed with the hopelessness of many of these cases that he advises no operative interference should be attempted except in the more chronic variety of case, where the disease has become encysted   He demonstrates that in this variety of the disease operation is followed by a mortality of 30 per cent

Upon this question we take an entirely different view   We believe that early operation affords the best prospects for recovery   As soon as the condition is recognized drainage of the peritoneal cavity is carried out under gas and oxygen anæsthesia   The drainage is at the most dependent point, and some of our best results have followed vaginal drainage   Until the period of the last year the early drainage operation might be said to summarize our line of treatment, but during the past twelve months we have improved the position by the addition of blood transfusion   This adjunct has already improved our post-operative results   and in the future we look forward to a greater reduction in the mortality   The transfusion is done by the citrate method, and the parents if suitable act as donors   It is important to recognize the precise time at which it can be done with the greatest possible advantage   That point is when the evidences of septicæmia are just beginning to make their appearance   This is very definitely the period of election   if done earlier the transfusion does not appear to prevent the onset of the septicæmia   if done later the heart may be so weakened that the quantity of blood which can be safely introduced is so small that relatively little beneficial effect can be looked for

As regards the quantity of blood which can be given to a child, say, of six years we

aim at the administration of 250 c c of blood   The change which the administration induces is often dramatic—the cyanotic tinge disappears and is replaced by a healthy, rosy colour, the restlessness abates, the pulse-rate slows, and the patient often drops into a sound sleep

Perhaps the most striking testimony to the value of blood transfusion in pneumo coccal peritonitis is evidenced in the following mortality figures —

Taking the total number of cases operated on at the Children's Hospital during the past twenty years, the mortality figure averaged 65 per cent   During the year 1920 the mortality figure was 53 per cent, an improvement which we ascribe to earlier recognition of the cases, to earlier operation, and to more suitable methods of anæsthesia   During the year 1921, in which blood transfusion has been adopted as a routine at the critical stage of the disease, the mortality figure has fallen to 42 per cent

SUMMARY

1   There is an essential division of pneumococcal peritonitis into two classes—primary and secondary

2   The primary class is peculiar to the female sex, because it is the result of infection of the peritoneal cavity from the genital tract

3   The primary type, according to the acuteness of the infection, may be subdivided into three different varieties—fulminating, acute, and chronic

4   Primary pneumococcal peritonitis begins as a pelvic peritonitis, and in a typical case the clinical features afford strong evidence of the pelvic distribution

5   The course of the disease shows two distinct stages—introductory and septicæmic

6   The mortality figures of the disease have been greatly diminished by the adoption of blood transfusion at the commencement of the septicæmic stage of the disease

Our thanks are due to Professor Sir Harold Stiles for the access which he gave us to earlier case-records, from which we derived valuable statistical evidence

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A CASE OF EPILEPSY OF 22 YEARS' STANDING DUE TO A CALCIFIED ENDOTHELIOMA OR PERITHELIOMA IN THE LEFT LATERAL VENTRICLE: REMOVAL AND RECOVERY

By Sir JOHN LYNN THOMAS, K B E , C B , C M G , Cardiff

I am indebted to my late house surgeon, Dr Fergus Armstrong, for the following clinical history

Mrs C L , housewife, age 48, was admitted to the Cardiff Infirmary, June 3, 1911, suffering from epilepsy which had existed on and off for twenty-two years   During this period she had been seeing medical men continually, and also quacks   Patient is a thin anæmic woman   Pulse 84   Temperature 98 4°   Has a severe headache of the left frontal region   She was sent for treatment by Dr C A Jones, Penarth, after consultation

History —There is no trace of any mental or nerve trouble in parents and family There is no evidence of syphilis, tuberculous disease, or of epilepsy in the family   There is one child alive and healthy at the age of 13 years   Patient has suffered previously from rheumatism, and frequent colds   Had an operation for dysmenorrhœa many years ago

Present Illness —This dated back for twenty-two years, when she had a very bad attack of twitching of the right side   It began in the right ring-finger and fingers, and spread up the arm and down the whole of the right side of the body   She did not lose consciousness during the attack   A recurrence came one year later   These fits returned at intervals of about nine to twelve months for about fifteen years   At about the latter period she noticed a weakness of her right hand when playing the piano—the right ring finger being practically useless   The convulsions gradually became more severe, and she consulted Dr Long Fox, of Bristol, and was under his care for about a year, with no benefit to the fits   Later on the attacks became more frequent and severe, and she lost consciousness on six occasions , for the past three years the fits returned about every fourteen days and lasted for about half an hour to three hours

Examination of Nervous System —

Subjective Symptoms —

Headache —Is confined to the left frontal region, is of a dull aching character, and has been severe, especially of late   It occurs chiefly in the morning before breakfast and improves towards midday   Another attack comes on in the evening, but is not so severe

Fits —The first fit occurred at the age of twenty-six   No assigned cause   Interval of a year between each fit for the first fourteen to fifteen years   Latterly fourteen days' interval only   The onset is gradual, beginning with twitchings of the fingers of the right hand, and spreads over the right side to the right leg   Has lost consciousness on six occasions   Shortest attack lasts about half an hour, the longest three hours   Clonic contractions   Headache often after a fit, but there is no aura present   Paralysis of right side results for an hour or two after a fit, and a marked Babinski, which gradually lessens after the attack   Attacks of *motor aphasia* often follow fits

Objective Symptoms —

1 *Intellectual functions* —The only one involved is speech , for the past year this has been the case, and she has noticed a lack of expression in words when addressing her servant   is always worse after an attack   Writing has been impaired, not from agraphia, but from muscular weakness of the right hand

2 *Cranial nerve functions* —No abnormality detected   Has not noticed any difference in sense of hearing smell taste or vision

3 *Motor functions*—The muscular power of the right limbs is impaired   Power of grasp and all movements of the right limbs are markedly diminished   Gait has been interfered with during the past year   she drags her right leg a little and cannot raise it   Muscular nutrition of the right side is impaired, being especially marked in muscles of the arm, which are wasted and flabby

4 *Sensory functions*—Pain, heat, cold, and touch sensations are all diminished over the right side, in both limbs and trunk, and are most marked over the front of the forearm. There is complete loss of the stereognostic sense in the right hand (astereognosis)

5 *Reflexes*—

Superficial reflexes   Babinski s is very marked, and particularly so after a fit , but is always present on the right side   Left plantar reflex is flexor

Deep reflexes   Knee-jerk and all other deep reflexes are markedly exaggerated on the right side , ankle clonus is present   Left side normal

Organic reflexes   Deglutition, defœcation, and micturition are normal, and the sphincters are not involved

6 *Vasomotor and trophic changes*—No joint or skin changes are observable

OPHTHALMIC EXAMINATION   July 7, 1911—Report by Dr D Leighton Davies ophthalmic surgeon   Pupils react to light and accommodation   both optic discs are normal, but there is a distinct enlargement of veins in the left fundus

RADIOGRAM, July 6, 1911—Report by Dr Owen Rhys, radiologist, Plate taken with anticathode centred over the temporosphenoidal region   Two plates show a distinct dark mass, about ½ inch above the pinna of the left ear

Operation, July 7, 1911—The operation was performed with the patient in the Albert Kocher s position for goitre   open ether was given by Dr Alexander Brownlee   The Rolandic area was mapped out by Bennet s method   At right angles to the sagittal suture two parallel lines were drawn   (*a*) The anterior ran along the interior margin of the external auditory meatus , (*b*) The posterior touched the posterior margin of the mastoid (MacEwen)   These two lines were scratched on the scalp after the fashion introduced some years ago, and became prominent on being painted over with tincture of iodine The two temporal blood-vessels were controlled by a temporary thick-thread ligature under-running   A 'c -shaped incision was now made in the scalp down to the bone, and the scalp adequately reflected   The flap was about 2 inches across and 2 inches high   With a Doyen s burr the skull was penetrated at two points   (*a*) The antero inferior part of wound   (*b*) The postero inferior part of wound   These two points were joined by making a c -shaped roadway in the bone with the gap of the c below by means of Jones claw-forceps   When the skull had been completely divided, the bone and soft parts adherent to it (skin temporal muscle periosteum) were turned downwards by breaking the bridge of bone at the base   The soft parts acted as a hinge The dura was now examined, and no abnormality was detected by inspection or palpation

The dura was incised, and no abnormality of the cortex cerebri detected   but on palpating in the postero inferior angle of the exposed brain a hard mass was felt subcortically   An incision was made over this and the iodized index finger passed in   and a large calculus was removed without difficulty (*Fig* 170)   The lacerated bleeding brain was ligatured and removed around the opening made by the finger and the tumour   The dura was now sutured and the bone flap replaced   A small glass drainage tube was placed in the wound down to the sutured dura   Michel clips were placed in the skin   and a triangular dressing was applied to the head   The patient bore her operation well   and what little hæmorrhage occurred was easily controlled by forceps and Horsley s wax

FIG 170 —Showing the removed calculus (*natural size*) Greatest length=1¼ in   greatest width=1¼ in   Weight of specimen after excavation, for examination 1 9 gram

Post-operative Progress —

July 8, 1911 —There is complete paralysis of the whole of the right side, and rigidity Babinski, knee-jerk, ankle-clonus, and triceps-jerk are all marked and exaggerated on the right side

There is complete motor aphasia   The only words articulated being confined to 'no' and 'yes', to such questions as   How are you to day ?   An automaton off the big broken lines of transmission of ideas of response

Vomited twice to day   The wound was dressed, and two small rubber drainage tubes were put in   The tongue deviates to the right, and the right eye cannot be closed readily

July 9 —All superficial and deep reflexes very marked   Motor aphasia is still bad, but the patient can articulate a little better to-day   There is right-sided rigidity , but she moved the right leg twice during the night   Slight drooping of the right side of the face, and the tongue deviates to the right   The right pupil is dilated but reacts to the light   Pain and touch are diminished but not absent

July 10 —Dressed, tubes now removed, and the wound is sealed with bismuth and collodion   Babinski is still marked   Slight dilatation of right pupil persists , but it reacts to light and accommodation   Knee-jerk is exaggerated   Ankle clonus present Triceps-jerk is markedly exaggerated   Motor aphasia is much less   Pain and sense of touch are diminished on the right side   Rigidity is passing off the right arm and leg

July 11 —Patient can now grasp with the right hand, but reflexes are still very exaggerated   Eyes   pupils are quite equal, and react to light and accommodation   No headache

July 12 —No rigidity to day   The eyes are equal, and react to light and accommo dation   Speech and grasp are both improved   Babinski, ankle clonus, trunk reflexes, knee jerk, and supinator jerk, are present on right side

July 13 —Much the same as yesterday   Head was dressed   Clips were removed Anterior three-quarters of the wound quite healed   The two holes which contained the drainage tubes are the only parts of the wound now open   Sealed again with bismuth and collodion, and one layer of gauze

July 14 —*In statu quo*   Has a bad headache in the frontal region left side

July 15 —Right side is quite flaccid   All reflexes are exaggerated, and Babinski is very marked   The right side of face is now normal and the tongue does not deviate to the right , pupils are equal

July 16 —Very slight headache   The patient can move the arm and leg to day with ease   The power of grasp is returning

July 17 —Pain and touch sensations are markedly improving, and motor aphasia is passing off

July 18 —The head wound is quite healed, but patient still complains of headache Babinski is much less marked than four days ago

July 19 —The patient has no headache to day, and moves her arm and leg with ease Has been having massage for the past five days

July 20 —The motor aphasia is very much less

July 22 —Reflexes on the left side are normal , there is still marked exaggeration of all on the right side   Knee-jerk   Babinski, ankle clonus, triceps, and supinator longus are present on right side   Sensations are much improved   Pain sensation is returning rapidly, motor aphasia improving, agraphia and alexia are complete

July 25 —Tested patient's power of reading , alexia and agraphia absolute

July 27 —Patient was x-rayed to day   The radiogram is reproduced (*Fig* 471) Ocular fundi were examined and both found to be normal   Reflexes on right side are all exaggerated, but motor power is much improved

July 29 —Stereognostic sense is absent on right side—tested by a matchbox, an egg cup, a reel of cotton, the forefinger, and a lump of sugar, none of which could be distinguished   Kinæsthetic sense was unimpaired , two boxes, one empty, the other full, were distinguished without any trouble

Oct 20 —Much improved, patient walks fairly well, but drags her right leg The reflexes are all right Stereognostic sense is still absent Pain touch, and heat and cold sensations are improved on the right side Speech is improved There have been no fits since the operation

I am greatly indebted to Professor S G Shattock, F R S , of the Royal College of Surgeons of England, for the following pathological description of the tumour removed —

Fig 1 1 —Skiagram taken after removal of the brain tumour A A The C   shaped roadway made by Lane's claw forcep B The bone flap C C The torn base of the bone flap D Temporomaxillary joint, E The external meatus

St Thomas's Medical School, London
Feb 27, 1912

The material is readily crushed into powder, and after treatment with alcohol, and examination in diluted glycerin the calcareous substance has a distinctly fibrous' disposition On treating the powdered material with hydrochloric acid in microscopical preparations made with water no evolution of carbonic acid gas occurs, and the fibrinous'-looking material is resolved into closely applied flat cells The tumour must be classed, therefore, as a calcified endothelioma or perithelioma

S G SHATTOCK

I am indebted also for a further report by Professor Benjamin Moore, F R S , which I obtained through my friend Professor E Emrys-Roberts, and which is as follows —

Bio Chemical Department, University, Liverpool,
April 9, 1912

Report on calculus submitted for examination by Prof E Emrys Roberts

The percentage composition of the material is is follows   Water 12 8   Organic matter 32 8   Inorganic matter 54 4   The inorganic matter consists, practically exclusively, of calcium phosphate [$Ca_3(PO_4)_2$]

In the organic matter there is a trace of cholesterol, but the other soluble fraction is unweighable, so that the percentage of cholesterol and fats is very small

The organic matter is highly nitrogenous, containing about 9 per cent of nitrogen (i e , 3 01 per cent of the entire stone)   It contains, however, no uric acid   There is present some material which gives an intense orange colour in carrying out the murexide test   A similar substance I have found lately in the plaques from degenerated arteries, but have not been able to identify it is not xanthine or any of the known purin bases   The nitrogen content would allow for about 15 to 20 per cent of such a body

BENJAMIN MOORE

✔   ✢   ✵   ✸   ✷   ▸

There are several points of interest in this case and perhaps one of the most remarkable is its chronicity, for I heard this year (1921) that Mrs H is still alive, and has not had more fits   When I last saw the patient she had athetotic movements of the right hand which she could control with the left, and she was doing her household work

The *x*-ray photograph was of material advantage in the course of the operation, for on finding the cortex cerebri perfectly healthy, one proceeded with confidence into the interior of the brain in search of the opaque *x* ray body

I think for the general surgeon who performs occasional decompression or exploratory intracranial operations, that a Doyen's burr and Lane s forceps take a place in the front rank

THE USE OF PITUITRIN IN INOPERABLE CANCER

By J H NORGATE, Bristol

In the wards of a huge Poor-law Hospital are always to be found many cases of malignant disease in their later stages   These patients have been seen at other hospitals, possibly been operated upon without success, and eventually drift to their last resting-place labelled as 'inoperable and incurable'

There are four cardinal points present in these cases   (a) Hopeless melancholy, (b) Profound cachexia, (c) Liability to hæmorrhage, (d) Offensive discharges   In the Southmead Infirmary, Bristol, during the past year exactly 100 cases of malignant disease have been recognized, and although it may not always be kind to prolong the lives of such poor sufferers, yet if anything can be done to combat these four points and to give some sort of comfort to the patients in their last days, it is our duty to do it   By letting them drift into the next world with the kindly aid of morphia we miss the opportunity of studying the disease, and the cure and cause of cancer will never be made plain   The post-mortem findings of a case of cancer are not so interesting as the gradual watching of the progress of the case—which, by the by is not often seen by the student in the general hospitals of the present day, owing to the hiatus, shall I call it between the operating theatre and the mortuary

During a severe outbreak of enteric fever in 1919, finding that pituitrin (posterior infundibular) controlled the hæmorrhage cases without any bad symptoms, I tried it on a case of sudden and severe hæmorrhage from an extensive epithelioma of the tongue with enlarged cervical glands, by injecting 1 c c into the tongue muscle

Case 1 —Epithelioma of tongue

H M male   The patient was blanched and apparently choking from hæmorrhage   On injection of pituitrin all bleeding stopped at once, and there was no repetition of it throughout his case   the glands decreased in size, and in a week he could take solid food   I gave him weekly injections into his tongue for three months, and he made rapid improvement, put on flesh, and the cachexia disappeared   He continued nine months in this state, then a hard mass formed in his liver the growth in the tongue remaining the same, the glands slightly enlarged, and he died very emaciated   The first injection was given on May 12, 1919 and he died on April 27, 1920 His melancholy and suicidal tendencies improved up to about a month before his death

Case 2 —Malignant growth of lower jaw

J J R male   A railway porter, admitted to the Southmead Infirmary, March 16, 1920 He had been pronounced inoperable at both hospitals in Bristol, sections were taken of the growth   There was a history of illness for eighteen months   a large growth was present underneath the tongue hiding it from view, starting on the left side of the lower jaw, and forming a huge fungating growth in the neck and indurated   truffle -like excrescences in the chin   There had been frequent and very severe hæmorrhages from the mouth, and another occurred in the ambulance on the way to the hospital   He had been fed through the corner of his mouth by a rubber tube fixed on to a feeder   He was very anæmic and emaciated, and there was extreme fætor so much so that the other patients made a complaint about it   Two days later I was summoned from a distance to see him, as he was then bleeding furiously from his mouth   I injected 1 c c pituitrin into the centre of the growth, and hæmorrhage ceased at once   During twenty one months he had from one to two injections every week either into the growth itself or into the chin but later, when the tumour became too sessile the injection was apt to be wasted, and there was little result   He had only two hæmorrhages, the first when I inadvertently put the needle into the inferior dental artery, the second in the week before he died , in both cases they were at once relieved by an injection   Fig 172 depicts the growth before and after a typical injection of 1 c c   The patient gained weight and was able to eat solid food up to a month before he died   The discharge was not at all objectionable, and was of a milky purulent character   His tongue became clearly visible and movable, and the whole growth had gradually shrunk in size,
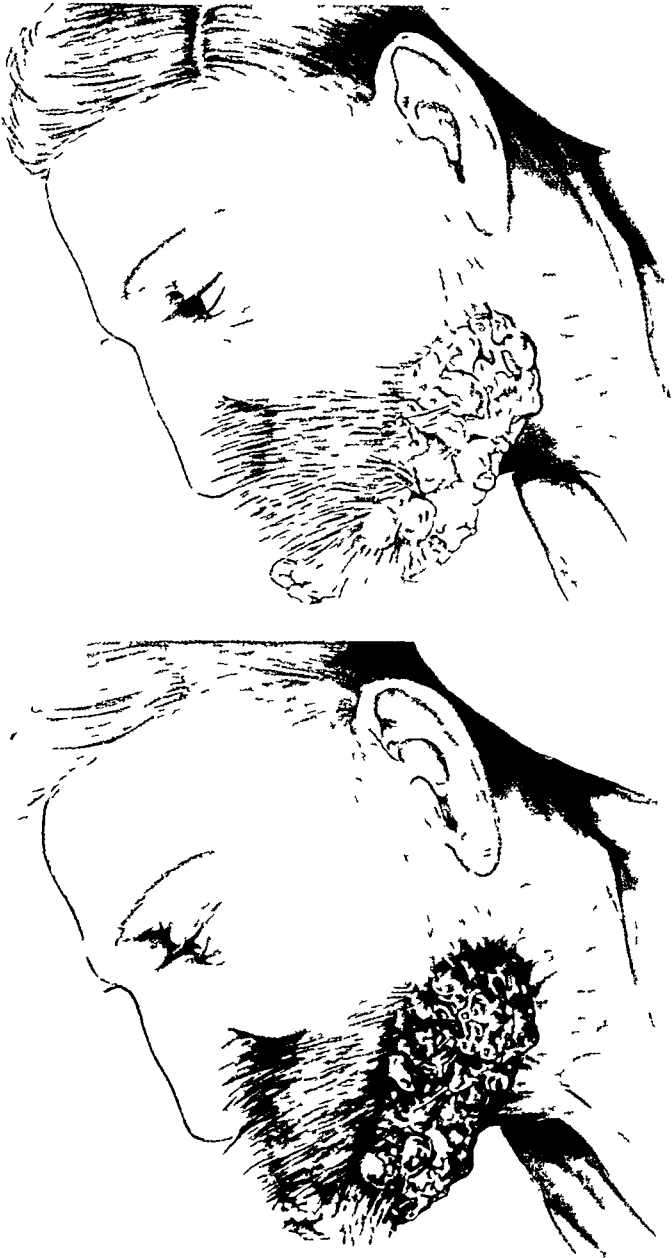
FIG. 172.—*Case 2.* Before and after injection with 1 c c of pituitary gland extract

leaving a well marked scar in places where the skin had healed   He had been up, and about the grounds for quite twelve months, and enjoyed life, being very bright, cheerful, and hopeful

Within a few seconds after the   more rapidly in the later ones—he has always become intensely anæmic,   his spine—" as if the spine was being crumpled up ", in a few minutes he was himself again

The effect on the growth was of great interest, as it could readily be seen on the large surface on his cheek   The colour gradually faded until it was almost paper-white   The whole growth appeared to shrivel, it exuded a milky-white fluid   and remained contracted for about twenty minutes   The growth did not bleed when the circulation was restored   It was interesting to watch the healing process, and to see small fibrous bands forming in the growth and dividing it up into sprouting spaces   As it gradually healed on the left side of the face, it approached the mid line of the neck

Two injections a week gave no better reaction than one   The patient appeared to look upon them in the light of a tonic   He developed no more enlarged glands, and no secondary growths elsewhere   During his last month he had great dysphagia and dyspnœa, and the growth had appeared again under his tongue   He died Nov 12, 1921
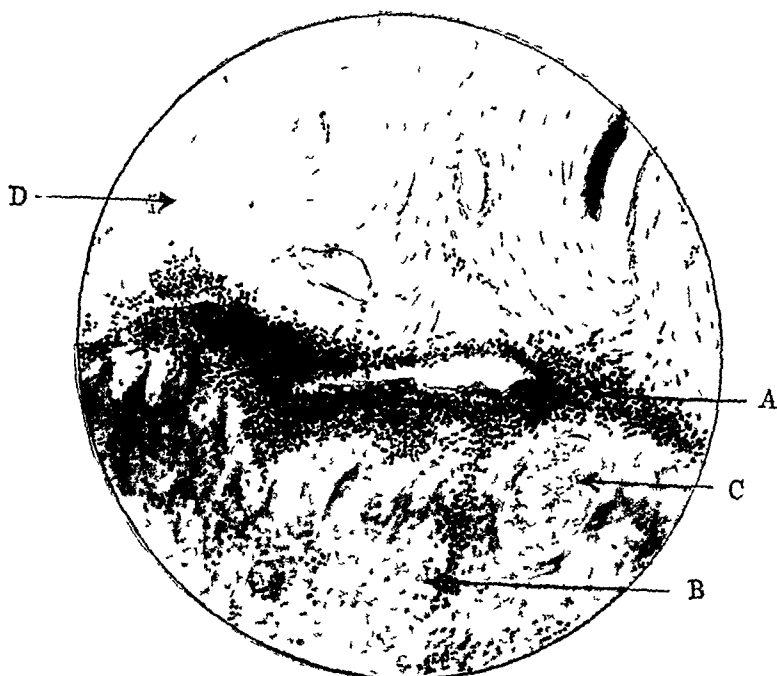
Fig 472 — Case 2   Section of tongue at the edge of new growth
A Zone of intense inflammatory reaction at edge of growth   B Growth   C Thrombosed vessel
in growth   D Fibrotic tissue replacing tissue of tongue   (× 2 obj)

The post mortem showed no secondary growths in other organs, but the original tumour had extended downwards towards the pharynx and air passages   The external growth had shrunk from the level of the external meatus to a point 1¾ in from the lobule of the ear   There was also cirrhosis of the liver (alcoholic), and a cyst of the left kidney   The heart and lungs were quite normal

Pathological Report by Dr Hadfield, Pathologist to the Bristol General Hospital
Three pieces of tissue were received for section   (1) Portion of original tumour , (2) Sessile portion of original tumour , (3) Skin previously affected by new growth
Sections of 1 show a projecting mass of completely keratinized squamous epithelium, lying on a thick base of tumour tissue, whose general structure and arrangement is typical of a rather slowly growing squamous celled carcinoma, except that practically all the vessels supplying the growth are thrombosed   and their lumina filled by many polymorphonuclear leucocytes   In consequence, in several parts of the growth there are obvious degenerative changes, the most common consisting of focal collections of degenerate tumour cells, containing nuclear fragments, and surrounded by a cell exudate of mononuclear cells and polymorphonuclear leucocytes   The tumour tissue between these foci shows no marked changes (Fig 473)
Sections of 2 show the same essential changes as (1), but cell-nest formation is more perfect, This part of the tumour was originally of slow growth   The keratinized centres of many of the

cell nests are infiltrated by phagocytes, and the growth generally shows much more widespread degeneration

Sections of 3—The pathological changes in the sections of the skin previously affected by the new growth are confined to the subcutaneous tissue The skin is intact, there is no epithelial down growth , there is a diffuse subcutaneous inflammatory reaction superimposed on a very obvious general fibrosis This reaction is perivascular in distribution, and a cell exudate surrounds most of the vessels, a few of which are thrombosed There is no evidence in the section of malignant disease There are many sebaceous glands which appear normal

Conclusions—(1) Both sections of the tumour are typical of squamous celled carcinoma, with areas of degeneration, due to the thrombosis of the vessels supplying the growth , (2) The degeneration is focal, the tumour tissue between is active , (3) The changes are not typical of infection, but closely resemble those produced by x rays

Out of the 100 cases in the hospital I have injected 36, with varying results , 3 have been successfully operated upon by the surgeon The seat of injection varies , preferably it should be into the growth itself, especially in the mouth For bladder vaginal, and rectal cases it is made into the perineal tissues or the buttocks

The immediate effects vary In twenty seconds the patient feels a severe pain either in the back or abdomen, and a sensation of squeezing of the growth Then follows the intense anæmia, which may be frightening at times, with weakening of the pulse , a little brandy will relieve this at once, but it is better to let the patient feel the full and prolonged effect if possible, as the constriction of the vessels is greater Some cases have reported a sensation of impending death, and a gradual return to life, but there has been no loss of consciousness

I have used Ferris and Co and Parke Davis preparations, and the patient will soon gauge the strength of the preparation by its effects upon him I find the anæmic cases after severe hemorrhages present some difficulty , the pituitrin helps them, and if discontinued there is a liability to sudden collapse The pain has been relieved in many cases , but when the ulceration extends and deep nerves are affected, morphia becomes a necessity —the pituitrin loses its effect I withhold morphia as long as possible

I have given 5 c c in enteric hemorrhage in twenty-four hours without ill effect, but have not gone beyond 3 c c per week in cancer cases There has been no death within a week of an injection It should be given in bed and a rest of one hour in bed afterwards is advisable There has been no nausea or vomiting after the injections An improvement in appetite and gain of weight have been seen in almost every case, and the patients' impression that something is being done for them has dissipated their melancholy , it is not very cheering to be told that nothing more can be done for one

I have noticed an effect of pituitrin in delaying the onset of secondary glands and growths, also the tendency it has to break down and liquefy the hardened masses, and to render the growths abortive, and I would advise its use after primary operation on a growth to prevent a recurrence in the nearest glands Secondary deposits in other parts of the body are conspicuous by their absence after pituitrin

There appears to be a point beyond which it is not advisable to go—the patient can hold no more in his system—especially in aortic disease I am sure that pituitrin is the most powerful drug we have in use for prevention and stoppage of hemorrhage in cancer cases its action is certain, very prompt, and very lasting The effect on the discharges is various in some cases it is very deodorant if given into the growth itself in others not so

No claim can be made that pituitrin is a cure for cancer, for it only delays the growth by cutting off its blood supply for a limited time but as a general tonic to the system as a great antagonist to cachexia and its attendant distress of mind and body, and is in agent in producing a remission for a time of the last sentence which we know must irrevocably be carried out, its value is great This prolongation of life for a year or more in patients who might have been expected to live about a month, has been of great interest, and has given me encouragement to hope that further experiments may lead to the unlocking of the hitherto closed door that leads to the cure of cancer

My thanks are due to Dr Hadfield for his examination and report of the specimen submitted to him, and to Miss Pillers for her drawings

FURTHER REPORTS OF CASES

Case 3 —Epithelioma of hand

J T , male, age 79   Always refused amputation   Had injections for 5 months   First injection, May, 1919   Improvement at first , tumour now growing more vigorously , patient losing weight , no secondary growths in other organs , a few glands in axilla , no hæmorrhage   Injection into wrist

Case 4 —Carcinoma of cervix

C R , female, age 83   Cancer affecting vaginal walls , severe hæmorrhage and fœtor   Three injections   First injection, June, 1919   Keeping fairly well , no hæmorrhage   rather offensive discharge , losing weight slowly , no cachexia now   Injection into vaginal wall and perineum

Case 5 —Carcinoma of rectum

J I , male, age 70   Severe hæmorrhage and fœtor   Three injections into perineum   First injection, Sept 24, 1920   Cachexia gone , up and about all day , huge mass still to be felt in rectum, hollowed out , no hæmorrhage, and little discharge

Case 6 —Large growth in right antrum

H J , female, age 75   Growth appears through nose and roof of mouth, growing from a tooth   Tumour known to have existed for 3 months before admission   First injection, Oct 20, 1920   Marked effect and anæmia   Growth halted for 9 months , now growing very slowly , no cachexia   slight hæmorrhage once

Case 7 —Carcinoma of labium majus

R B , female, age 70   Inoperable on admission, growing then 6 months   First injection, Dec 1, 1920   Six injections , refused more , still alive , has had no hæmorrhage , fœtor now more marked , gradually tunnelling out the pelvis , general health fair, but anæmic , has morphia at night

Case 8 —Carcinoma of rectum

H P , male, age 62   Offensive discharge and slight hæmorrhage , very anæmic on admission   Had four injections into perineum   First injection, Oct 20, 1920   Cachexia now gone , no hæmorrhage , tunnelling of growth now going on , was melancholic, but is now bright

Case 9 —Malignant disease of breast

C T , female, age 72   No ulceration , secondary glands neck and chest   First injection, Oct , 1920   No progress of tumour , glands much the same , no cachexia , seems in fairly good health

Case 10 —Carcinoma of cervix

S D female, age 43   Severe hæmorrhages and fœtid discharges , losing weight rapidly   First injection, Sept , 1921   Comes up fortnightly for injections into perineum , is looking better , has had no more hæmorrhages, and discharge is less offensive , much brighter

Case 11 —Epithelioma of tongue

S A male, age 59   Severe hæmorrhages, always controlled by pituitrin into growth , marked fœtor with emaciation   No real improvement except control of hæmorrhage   Died in five months

Case 12 —Carcinoma of breast

A B female, age 56   Growth 3 months   Secondary glands in axilla   Very obese woman   Also cardiac dilatation and asthma   Admitted Oct 4   First injection, Oct 10, 1920   After two injections the whole solid mass of breast broke down and discharged, leaving a shell of skin and muscle   no hæmorrhage after, but fœtor very disagreeable   Had four injections   Very delirious and noisy   morphia   Died in Jan , 1921 in a heart attack

Case 13 —Carcinoma of breast

L D female, age 72   Growth 9 months   There is a deep, depressed circular pit over left breast with hardened edges, exposing the ribs with deep infiltration of the chest   Severe hæmorrhages controlled with pituitrin into the edges of the crater, marked fœtor and cachexia   First injection Nov 1 1920   Improved, and took her food well , glands in axilla disappeared after two injections   Relapsed, and died April 26, 1921

Case 14 —Carcinoma uteri

M D female, age 77   Severe hæmorrhages for 6 months   Admitted Nov 13   First injection Nov 20 1920   Hæmorrhages controlled by pituitrin, no more occurring , secondary growth in liver , improved a little   Died April 30, 1921

Case 15 —Cancer of tonsils and structures near

A D male, age 55   Admitted Dec 7, 1920   Many enlarged glands in neck give him much pain and extreme emaciation   great dysphagia and dyspnœa   Marked melancholia   First injection, Dec 10, 1920   Improved at first , no hæmorrhage at all   Died May 27 1921

Case 16 —Cancer of uterus
A J, female, age 32   Known to exist 1 month   Pelvic glands   Severe hæmorrhages and cachexia   First injection, Nov 5, 1920   Marked effect, no hæmorrhage   Died Jan 6, 1921

Case 17 —Carcinoma of cheek and antrum
R M, male, age 85   Three months' hæmorrhage and extreme fœtor   First injection, Oct 12, 1920   Breaking down of mass and glands, and clearing out of whole of right side of mouth, intense fœtor, no hæmorrhage   Died Jan 1, 1921

Case 18 —Carcinoma of rectum
M Q, female, age 56   Hæmorrhage and cachexia marked   First injection, Oct 20, 1920   Had several injections weekly   Cachexia markedly improved, no hæmorrhage, fœtor bad towards the end   Died June 10, 1921

Case 19 —Epithelioma of tongue
W S, male, age 72   Locked mouth and huge growth in neck on right side   First injection, Oct 23, 1920   Two injections liquefied the growth in the neck, and it discharged externally   Unable to be fed by the mouth, which was in a terrible condition   Died of septic pneumonia Nov 4, 1920

Case 20 —Carcinoma of breast
D S, female, age 69   Glands in axilla   Also aortic valvular disease   First injection, Dec 30, 1920   Had little, if any, effect   Died Feb 16, 1921

Case 21 —Carcinoma of breast
R T, female, age 75   Secondary deposits in hip after removal of breast, spontaneous fracture   First injection, Dec 20, 1920   Little, if any, improvement   Early morphia   Melancholia supervened   Died April 30, 1921

Case 22 —Carcinoma of neck
T Y, male, age 48   Huge glands   marked cynosis, mental symptoms, locked mouth   Two injections   No improvement beyond softening of glands, which relieved pressure on his vessels   Removed to insane wards, and died soon after

Case 23 —Epithelioma of larynx
R B, male, age 83   Tracheotomy   First injection, May 4, 1921   Improved up to a point, appetite better, and much more cheerful, growth spread to the œsophagus, no hæmorrhage   Died Oct 22, 1921   Growth 8 months

Case 24 —Cancer of uterus
E C, female, age 76   Severe hæmorrhage and cachexia   One injection given March 20, 1921, that controlled the hæmorrhage   Made no progress   Died May 9, 1921   Growth 6 months

Case 25 —Cancer of left breast
A C, female, age 57   Similar to Case 13   Deep pit with raised edges   Admitted July 29, 1921   Severe hæmorrhages at every dressing, marked anæmia and cachexia   First injection, Sept 6, 1921   Glands in axilla disappeared after few injections   Now getting worse, and walls breaking down   Growth 9 months

Case 26 —Epithelioma of lower lip and jaw
W D, male, age 74   Fungating mass with glands   Extreme anæmia and cachexia from repeated hæmorrhages   First injection, June 20, 1921   No further hæmorrhage, and some improvement   Died in lavatory, Aug 12, 1921   Growth 9 months

Case 27 —Cancer uteri
C L, female, age 56   Very advanced, frequent hæmorrhages   First injection, Jan 5, 1921   No further hæmorrhage, and discharge less fœtid   Died May 4, 1921   Growth 6 months

Case 28 —Cancer of neck glands and tongue
S L, male, age 55   Husband of Case 27   Fungating mass   First injection, May 1, 1921   Softening of glands, no hæmorrhage   Died May 26   Growth 6 months

Case 29 —Sarcoma of lower jaw
A D, male, age 48   Enlarged glands, no ulceration   Growing 3 months   First injection, June 30, 1921   Three injections produced intense anæmia of growth   Patient went out against medical advice   Growth softening   Mentally strange

Case 30 —Epithelioma of antrum
W F N, male, age 47   Two operations   Fungating mass   Admitted April 30, 1921   Several injections, which relieved pain and size of growth, no hæmorrhage   Morphia   Died Aug 11, 1921

Case 31 —Cancer of rectum

W O , male, age 70 Marked Nearly moribund on admission History of repeated haemorrhages Anaemia and cachexia very marked *First injection,* Feb 1, 1921 Improved very much at first , cachexia disappeared , able to be up and about Pain returned, and morphia was given Died Aug 1, 1921

Case 32 —Epithelioma of tonsil

E P , female, age 41 Spreading to tongue Many glands *First injection,* April 20, 1921 Improved at first , glands softened and discharged , less dysphagia , no haemorrhage Glands appeared on other side , jaundice Morphia Died June 18, 1921

Case 33 —Epithelioma of palate and tongue

S S , male, age 78 Repeated haemorrhages, rapidly controlled by pituitrin in mouth, not so quickly when given in arm Marked anaemia, cachexia, and melancholia *First injection,* Aug 1, 1921 Improved and took solid food Relapsed, and died Nov 2, 1921

Case 34 —Carcinoma of rectum

R W , female, age 79 Growth 9 months Repeated haemorrhages Admitted Jan 13, 1921 One injection stopped haemorrhage Secondary growth in liver Died June 22, 1921

Case 35 —Epithelioma of antrum

A W , female, age 77 Huge fungating mass growing through nose and mouth Sick 18 months , intensely anaemic, and cachexia marked *First injection,* April 22, 1921 Improved very much Had several injections Died suddenly Aug 1, 1921

Case 36 —Carcinoma uteri

E C , female, age 54 Intense anaemia Sick 9 months , cachexia and melancholia Admitted Aug 31 Had three injections Improved , no more haemorrhage Died Nov 12, 1921

Case 37 —Cancer of tonsil and palate

T C , male, age 72 Admitted Oct 23, 1920 Had several injections Glands softened, returned on other side , no haemorrhages after injections Died June 20, 1921

INGUINAL HERNIÆ · THEIR VARIETIES, MODE OF ORIGIN, AND CLASSIFICATION

By R. HAMILTON RUSSELL, Melbourne, Australia

PRELIMINARY NOTE ON INFANTILE (OR ENCYSTED) HERNIA

This subject is more than two centuries old, the first recorded case being that of a French surgeon, Mery, in 1701 [1] It would sometimes happen that in operating for a strangulated hernia the surgeon would find himself unexpectedly in a large serous cavity reaching to the depths of the scrotum in which the naked testis would be seen   Projecting into this cavity would be seen the strangulated hernia in its sac   It would receive the name 'infantile' if the hernia did not project markedly into the cavity, and 'encysted' if it did, and Lockwood was the first to point out that the two varieties were one and the same thing, distinguished only by very superficial and arbitrary points of difference

Infantile hernia is not really so rare as the small number of recorded cases would seem to suggest   It must be remembered, however, that the older surgeons, whose opportunities for gaining familiarity with hernia were confined to operations for strangulation, were placed at immense disadvantage when confronted with an unusual and mystifying abnormality, their experiences were likely to be unfortunate, their reports of cases correspondingly few, and, it must be confessed, their theories as to its mode of causation amazing

In 1886, the late C B Lockwood communicated the results of an exhaustive study of the subject [2] He demonstrated a fact that was very helpful indeed, and that badly needed pointing out, namely, that this form of hernia has its origin in none of the strange ways ascribed to it, but that it is a congenital abnormality, he further greatly cleared the air by showing that infantile and encysted hernia are one and the same, and he advanced an elaborate and ingenious theory as to its anatomy and mode of origin   And there, so far as teaching and text books go, the matter has remained   Lockwood's theory is to the origin and mode of causation of infantile hernia holds its place, apparently unquestioned, in all the text-books of the present day   How astonishing this is will perhaps be realized later, for years ago it was pointed out that —

1 The improbability of Lockwood's theory is of such a nature that we are bound to regard it, for practical purposes, as impossible

2 The true explanation of infantile hernia is very simple, and in complete harmony with the anatomy of all the other varieties of inguinal hernia   And then, the crowning revelation might have been added —

3 If for the sake of argument we were to assume Lockwood's theory to have actually materialized, the resulting hernia would not bear the least resemblance to infantile hernia (Detailed examination of these three assertions will be found under heading II)

So long ago as 1907 convinced that Lockwood had in some way been seriously misled, I contributed an article to the *British Medical Journal* on the morbid anatomy and pathology of infantile and encysted hernia pointing out the virtual impossibility of Lockwood's explanation, while at the same time indicating where, as it seemed to me, he had fallen into error and offering a simple solution of the problem [3] I treasure the courteous and appreciative letter I received from him at that time, expressing his renewed interest in the subject and his desire that he might find time to re study it in the light of what I had written   That, alas ! was never possible

In my paper I laid stress on the fact that it is not merely a question of what is right or wrong about infantile hernia, the point which is of the first importance is

that, while the acceptance of Lockwood s view sets infantile hernia apart, and renders any sort of relationship between it and other forms of hernia impossible, my view at once establishes the relationship, and makes a logical understanding and classification of all forms of oblique hernia not merely possible but very obvious

My paper having entirely failed to accomplish its object, I am impelled, having had fourteen years for thinking it over to 'restate my position I propose, however, to handle the matter somewhat differently in the hope of being more convincing I have treated the subject under three main headings In (*I*) is given a complete classification of all the varieties of oblique inguinal hernia, showing their serial relationship , (*II*) is devoted to the opposing theories as to the nature of infantile hernia , and, finally, (*III*) deals with direct hernia

I OBLIQUE INGUINAL HERNIA

All varieties of oblique inguinal hernia are determined by developmental variations in the anatomy of the scrotal peritoneum (processus vaginalis)

The scrotum is a specialized structure, virtually a portion of the abdominal cavity, formed for the purpose of giving lodgement to the testis and cord anatomically it closely follows the main abdominal cavity The layers of the abdominal wall are all represented in it under the name of ' coverings of the testis and cord ' , it is lined by peritoneum, and its contents covered thereby in precisely the same manner as that obtaining in the abdomen The scrotal peritoneum is called the ' processus vaginalis ', and is very simple is compared with the peritoneum of the abdomen, for it has to do with only two organs, the spermatic cord and the testis That portion of the processus vaginalis which is in relation with the cord will be called in this paper the ' funicular portion ' or ' funicular process ' , that portion which envelopes the testis (tunica vaginalis testis) will be called always, in this paper, the ' testicular portion '

About or soon after the time of birth, the funicular portion normally closes, and disappears throughout its entire length from the neighbourhood of the testis to the internal abdominal ring When this closure is perfect throughout, the individual is safe from the occurrence of oblique inguinal hernia of any kind But closure is by no means always perfect, and its mere deficiency is the determining factor in the origin of one (*Group A*) of the three groups into which I propose to divide the varieties of oblique inguinal hernia

The other two groups (*Groups B* and *C*) depend for their main characters upon a different kind of developmental event altogether The common and distinctive feature of both these groups is the accidental involvement of one or other portion of the processus vaginalis in the abdominal wall during the developmental happenings that eventuate in the formation of the scrotum and its contents In *Group B* the portion involved is the *funicular portion* , while in *Group C*, round which our interest will be found to centre and culminate, it will be the *testicular portion* which is involved

Group A —This group comprises two varieties of hernia only which owe their origin to the *funicular portion* of the processus vaginalis being (1) totally or (2) partially unclosed

1 *Total Failure of Closure* —The hernia if there is one, is free to pass into the testicular portion (total funicular hernia) (*Fig 474*)

2 *Partial Failure of Closure* —The hernia, if there is one will pass as far down the funicular portion as the length of the open tube permits, but cannot pass into the testicular portion (partial funicular hernia) (*Fig 475*)

[Note —I have suggested the names (1) *total funicular* and (2) *partial funicular* for these two varieties I hesitate to waste time in pointing out that the old nomenclature

FIG 474—Completely open funicular portion

FIG 475—Partially closed funicular portion
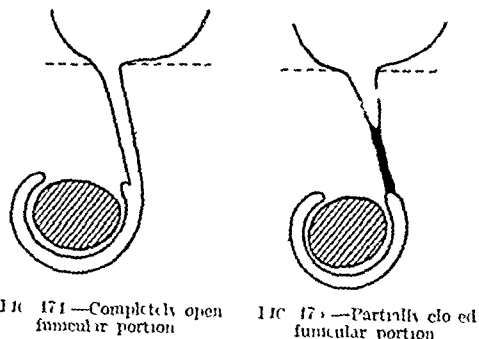
which still seems to maintain a somewhat ambiguous and apologetic hold upon life is simple confusion　Such terms as 'hernia of the acquired type', and 'hernia of con genital type' are the reverse of helpful　Both varieties are equally congenital, and neither is of the 'acquired type', a term which must be reserved for something very different from a partial funi cular hernia]
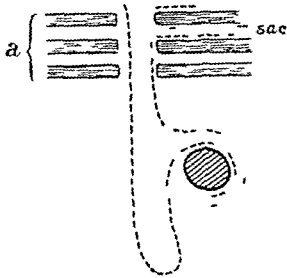
FIG　476 —Interstitial (inter muscular) sac implication of the funicular portion of the pro cessus vaginalis with imperfect descent of testis　(a) Three layers of abdominal muscles

Group B—The characteristic feature of this group of herniæ is a developmental accident that results in the 'catching up' of the *funicular process*, so that it becomes implicated with the developing abdominal wall in such a way that a lateral diverticulum or sac is formed at the spot　Moreover, this 'catching up' of the funicular portion frequently results in interference with the testis also, and that organ is unable to descend freely into the scrotum　Hence the frequent association of these varieties of hernia with imperfect descent of the testis　The relationship between these two events will be readily understood by a reference to *Fig* 476, in which the thick lines represent the muscular layers of the abdominal wall, and the dotted lines the processus vaginalis　In this figure the sac is intermuscular, and should a hernia pass into it the resulting hernia would be known as 'intermuscular'　But the sac might equally well have been a stratum deeper or a stratum more superficial, it might have lain between the abdominal wall and the peritoneum (properitoneal hernia), or superficial to the abdominal wall altogether (superficial inguinal hernia)　To sum up *Group B*, the three members of the group, named properitoneal, intermuscular, and superficial inguinal, depend severally upon involvement of the funicular portion of the processus vaginalis, and they are usually associated with imperfect descent of the testis

Group C—This group is formed by developmental accident, identical in nature with the foregoing, but in this case involving the *testicular portion* of the processus vaginalis, with most remarkable results　The descent of the testis is not interfered with, and that being so, it is inevitable that the anchored testicular portion should be drawn out into a long process as shown in *Fig* 477)　In this figure the funicular portion will be seen to be unclosed throughout, while

FIG　477 — Hernia magna

the long process from the testicular portion lies anteriorly and reaches upwards to the abdominal wall

This being the condition at birth, the subsequent behaviour of the funicular portion as to closure assumes more than ordinary importance　What will it do ?　It is quite unaffected by the accident that has happened to the testicular portion, and it may pursue any one of the three courses described under *Group I*　Thus
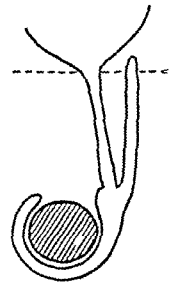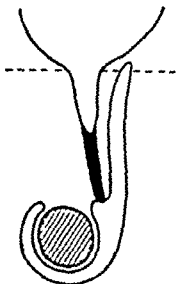
FIG　478 —Infantile hernia

　　1　*The Funicular portion may Close Throughout*—In this case the individual will have no hernia　but he will have a very large tunica vaginalis which may or may not become evident at some time by becoming the seat of a large hydrocele

　　2　*The Funicular portion may Remain Open Throughout*, as in *total funicular* hernia (*Fig* 477)　In this case the individual if he has a hernia at all, will be afflicted with an enormous one—one of those hernie that early cause the penis to disappear altogether, and that tend eventually to accommodate a large portion of the intestines (hernia magna)

　　3　*The Funicular portion may Partially Close*, as in *partial funicular hernia* (*Fig* 478) In this case the individual, if he has a hernia at all, will have to all appearance an

ordinary moderate or small inguinal one   If he submits to operation, the surgeon will, at the first incision through the skin, open a large serous cavity extending down to the depths of the scrotum, where he will find the naked testis   He will then be wise to cut through the posterior wall of the serous cavity straight on to the sac, which he will find to be in perfectly normal relation to the structures of the cord   He will then complete the operation which should present no special difficulty in the ordinary way

This is what has been known as infantile (or encysted) hernia , it is needless to go into the question as to why it received these names, but anybody who chances upon a case on the operation table, or who studies the small amount of literature there is on the subject, will, I think, very readily satisfy himself that it must be as I have described it

[*Note*.—I wish specially to call attention to the close relationship existing between the partial and total funicular varieties of *Group A*, and the 'hernia magna' and infantile varieties of *Group C*   It will be noted that the sole point of difference between the two *Groups A* and *C* is in the developmental accident that has distorted the testicular portion of the processus vaginalis seen in *Group C*, and it is this factor alone which converts the ordinary partial funicular hernia into the infantile hernia , and the total funicular hernia into the enormous 'hernia magna'

The 'enormous' variety of inguinal hernia seems never to have been recognized as a distinct variety, nor to have been accorded a distinctive name   It is, of course, just as distinct a variety as any other, and 'hernia magna' would appear to be the appropriate designation for it   The distinctive feature of 'hernia magna' is the disappearance of the penis in the tumour (*Fig 479*), leaving merely a round hole on its surface, which is the orifice of the prepuce]

FIG 479 — 'Hernia magna' in child Iodine preparations for operation

II THE CONFLICTING THEORIES AS TO THE ANATOMY AND MODE OF ORIGIN OF INFANTILE AND ENCYSTED HERNIA

I desire to place the above view as to the origin of infantile hernia side by side with Lockwood's well known theory, in such a way that the features of both may be clearly seen and contrasted   I have accordingly drawn the two diagrams (*Figs 480 and 481*) showing the anatomical problem presented by infantile hernia, and indicating the differences of opinion as to the identity of the several parts according to the descriptions of Lockwood and myself respectively

Lockwood's theory, it will be remembered, supposes the sac of an infantile hernia to be an abnormal structure drawn down into the scrotum by the tractive power of the gubernaculum testis   and it lies behind the processus vaginalis, which is closed at its upper end only

Lockwood's View.—1   The processus vaginalis is obliterated high up in the region of the internal ring, but open all the rest of the way down to the tunica vaginalis testis   This, to start with, is an excessively rare occurrence, so rare that I do not think I have ever seen it
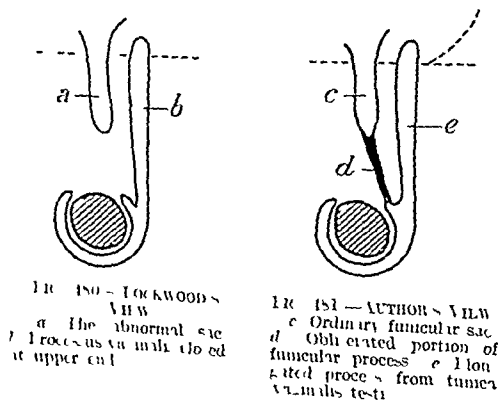
FIG 480 — LOCKWOOD'S VIEW
a The abnormal sac
b Processus vaginalis closed at upper end

FIG 481 — AUTHOR'S VIEW
c Ordinary funicular sac
d Obliterated portion of funicular process   *e* Elongated process from tunica vaginalis testis

2 The hernial sac is an abnormal one that comes down behind the processus vaginalis   This, again, I have never observed, and if it is possible, it must be excessively rare

We are thus compelled to assume that two distinct abnormalities, each of them so rare as to be practically unknown, should for some inexplicable reason have a way of occurring together in the same subject with such frequency as to warrant description as a special type of hernia   This is absolutely impossible of belief on the face of it

The Author s View —1 The long process of peritoneum in front, finishing in a blind end above, has resulted from the 'catching up of the testicular portion of the processus vaginalis in the abdominal wall during the descent of the testis, so that it becomes drawn out into a long process by the descent of that organ   Lockwood s error, according to my view, consisted in mistaking this process for the funicular portion of the processus vaginalis

2 The sac is a perfectly normal funicular sac, quite unaffected by the long process of peritoneum described in *Fig* 480   That the sac is a perfectly normal one is proved by its normal relation to the cord , this fact alone is fatal to Lockwood's theory   Thus it will be seen that, if my view is to be accepted, we need recognize but one very ordinary abnormality, which is the implication of the testicular portion of the processus vaginalis in the abdominal wall in the course of the developmental happenings that result in the complete descent of the testis into the scrotum

I have endeavoured to make a fair comparative statement of the conflicting theories of infantile hernia , but there is something further to be said   It appears to me certain that if, in spite of its virtual impossibility, we were to suppose a case brought about according to the accepted theory of Lockwood, the resulting hernia would not even remotely resemble infantile hernia   The reasoning is absurdly simple, and it is concerned with the characteristics of an unclosed funicular process   Every surgeon of experience knows quite well what an open funicular process that has never been occupied by a hernia looks like   he also knows that it is one of the most unobtrusive and evasive little structures in the body, and that in operations on this region (assuming that it is not being specially looked for) he is more likely not to see it than to see it   Now, I ask, can it by any effort of the imagination be supposed that this frail little tube could ever present itself in the guise of a large serous cavity passing down into the depths of the scrotum and occupied by the naked testis ?   As well mistake a glass marble for a football ! Again, let us go a step further and suppose an operation on our hypothetical case , what should we find ?   We should find a hernia with the structures of the cord lying in front of the sac , nothing more   But the whole discussion is now beside the mark, for there is no reason to suppose that any such case has ever existed

III   DIRECT INGUINAL HERNIA

There are two kinds of direct inguinal hernia, one of which is caused by a small congenital sac that usually comes straight through the conjoined tendon to project it the external ring   The other form, which is seen with great frequency, consists of a bulging directly through the posterior wall of the inguinal canal internal to the epigastric vessels   Often it is associated with a small funicular sac, in which case an oblique depression caused by the deep epigastric vessels will divide the tumour into two parts when the patient is examined in the standing position   This form is especially liable to appear for the first time in the later decades of life, and it is caused by congenital weakness of the musculature in the inguinal region   It is the only form of spontaneous hernia to which the term ' hernia of the acquired type ' is applicable, for it is the only form of spontaneous hernia that does not enter a sac that is pre formed   The question arises, Why should the muscles of this region be unduly weak in the case of some individuals ?   Further What is the relationship if any, between this form of hernia and the oblique form ?

I venture to advance the following line of reasoning   In oblique inguinal hernia the

failure of the funicular peritoneum to close, in fact all the various developmental accidents that we have been considering, must be regarded as evidence of developmental deficiency If we now study the phenomena presented by developmental defects elsewhere, we find always that the arresting influence, whatever may be its nature, involves not merely an individual structure, but a region, and that all the structures of the region are liable to be implicated in varying degrees

Almost any example will readily illustrate this principle In the face, for instance it is not merely that the palate or the lip fails to join up, there will usually be in addition a noticeable arrest of development seen in all the structures of the region, and their arrest is found to be very variable both in degree and distribution Sometimes it will involve the bones without any cleft in the palate at all, while, again, the palate will be cleft with but little appreciable deficiency in the bones And similar caprice will be noted elsewhere whether we look to the genito-urinary region or the vertebral canal

My point is that the muscles of the inguinal region are liable to participate in the same arresting influence that determines non-closure of the funicular peritoneum, but that the two things are not necessarily associated in any individual case By this I mean that we may have an open funicular peritoneum with perfectly formed muscles we may have congenitally weak muscles with a perfectly closed funicular peritoneum, and we may have them separately or together, in infinitely variable gradations And just as the hernia resulting from the open funicular process will necessarily be an oblique hernia, so the hernia resulting from muscular weakness will necessarily be a direct hernia Nor need we wonder that this form of hernia should be peculiar to the inguinal region, and solitary in the body, for there is no other example in the body of the part played by muscle similar to that played by the 'inguinal sphincter' in the prevention of hernia Many years ago, when writing upon inguinal hernia, I fell into error by failing to recognize the true relationship between oblique and direct inguinal hernia, I am glad to have this opportunity of acknowledging and correcting my mistake

I must, before concluding, allude to what is known as the "Saccular Theory of Hernia", first published in 1906 As the statement of a great general principle firmly based on truth, it has gained such acceptance as it was bound to, but I have never been quite satisfied While the principle has been accepted, it has not appeared to be so helpful in the actual practice of surgery as I hoped it would be I see now that the principle was not enough much more detail was essential, and it was lacking To tell a student that all spontaneous herniæ depend upon the presence of a pre-formed sac does not help him very much when confronted later with one of the varieties of hernia seen in *Groups B* and *C* Make him understand that the variety of hernia is determined by the shape of the sac, show him correctly what the shape of the sac really is, and how it has come about, and you will help him most notably, for you will have set his feet upon the only path that can lead to intelligent and confident operating

To supply this deficiency has been one of the objects of this paper, and I have added a 'synopsis' showing the relationship of all the varieties of oblique inguinal hernia, in the hope that it may perhaps be found of service in simplifying for teaching purposes what is without doubt, a somewhat complex subject

SYNOPSIS OF THE VARIETIES OF OBLIQUE INGUINAL HERNIA

GROUP 1 —The processus vaginalis is normal in shape The two varieties, (1) Total (*Fig* 482) and (2) Partial (*Fig* 483) funicular hernia, are the result of imperfect obliteration of the funicular portion of the processus vaginalis

GROUP B —The processus vaginalis is distorted by implication of its funicular portion in the abdominal wall, with lateral sacculation and interference with the descent of the testis Hence arise three varieties of hernia viz *Fig* 485, Preperitoneal, *Fig* 486, Intermuscular, and *Fig* 487, Superficial inguinal

GROUP C —The processus vaginalis is distorted by implication of its testicular portion in the abdominal wall, with the result shown in *Figs* 488, 489, 490   The character
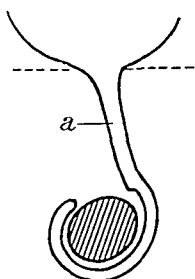
FIG   482 —Total funicular
hernia   a Funicular portion
of processus vaginalis
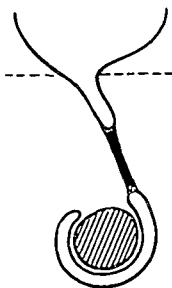
FIG   483 —Partial funicul 1
hernia
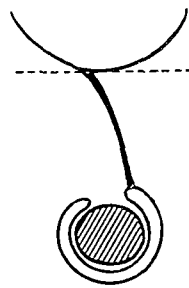
FIG   484 —No hernia
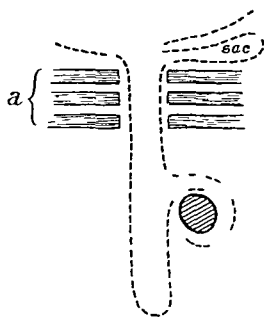
FIG   485 — Properitoneal
hernia   a Three layers of
abdominal muscles
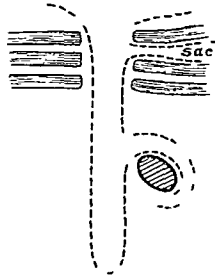
FIG   486 —Intermuscular
hernia
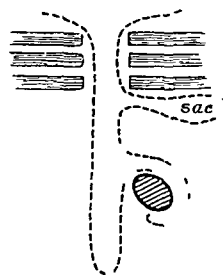
FIG   487 —Superficial
inguinal hernia
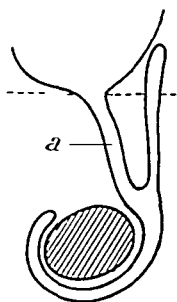
FIG   488 —Hernia magna
a Completely open funicular
portion
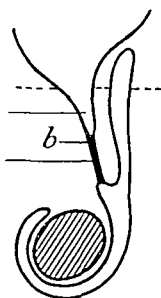
FIG   489 —Infantile hernia
b Partly closed funicular
portion
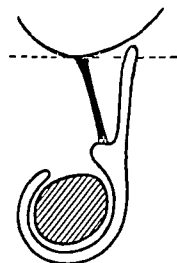
FIG   490 —No hernia but
potential large hydrocele

of the resulting hernia will then be determined by the behaviour of the funicular portion precisely as in *Group A*

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HYDRONEPHROSIS. *

By CHARLES A PANNETT, London

There is a large group of cases of hydronephrosis in which the dilatation stops short at the ureteropelvic junction, and either there is no obvious obstruction at that point or the factors which are generally accepted as producing an obstacle to the urinary outflow appear quite insufficient to play the part assigned to them The existence of these cases has been recognized by many surgeons Thus Albarran says " in a large number of cases the orifice of the ureter in the pelvis is cupuliform, normal, or even enlarged ", but he offers no explanation of this anomaly Braisch again, on page 126 of his book on pyelography, shows the photograph of a hydronephrosis in which he says that no cause was found for the obstruction at operation My object is to arrive at a truer conception of the genesis of these upper urinary retentions , to review modern methods of recognizing incipient hydronephrosis—for upon this will, in the main, depend the success of treatment , and finally to discuss what this treatment should be in the light of the facts brought forward

The problem may well be defined by describing the salient facts in the clinical aspect of three sufferers from this interesting pathological condition

Case 1 —A T , a woman, age 20, had an acute attack of pain in the right loin and then in the right iliac fossa Vomiting followed, and there was a temperature of 100 and a pulse of 100, with abdominal rigidity on the right side Cystoscopy showed the ureteric orifice to be normal in appearance , a specimen of urine from the right kidney was quite clear Laparotomy was proceeded with no intra-abdominal inflammatory lesion was discovered Right kidney enlarged and situated rather low During convalescence pyelography was done (*Fig* 491) and hydronephrosis was revealed Later, operation by another surgeon Kidney was exposed An abnormal artery crossed behind the ureter, but was not convincingly the cause of the obstruction the part of the pelvis outside the renal sinus was not dilated Both these findings corroborate the information furnished by the pyelograph for there is no dilatation immediately above the site of crossing of the abnormal artery, as one would expect in a hydronephrosis of such degree if that had been the cause The kidney was freely mobile It was fixed
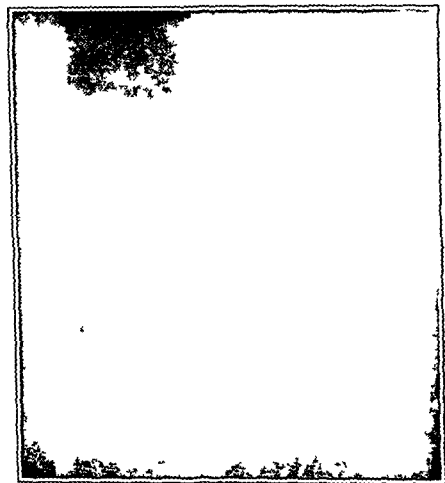
Fig '91 –Case 1

Case 2 —S W , a woman, age 62 Twenty years ago she had had her right kidney fixed During the year following this operation a lump appeared, and urine was aspirated from it on three occasions There had been no trouble since One year ago she had pain in the left side of the abdomen and a lump appeared which she noticed to vary in size She was admitted to St Mary's Hospital Clinical diagnosis hydronephrosis On cystoscopy and ureteral catheterization to test the function of the right kidney, the bladder and both ureteric orifices appeared normal Urine of SG 1015 was secreted by the right kidney but the urea percentage was only 1 2, an indication that nephrectomy on the left side was inadvisable At operation the left kidney was found to be abnormally mobile the pelvis was of such dimensions that it was eventually plicated It was opened and a large sized bougie was found to pass readily from the pelvis down into the ureter and bladder Nephropexy was performed Complete relief eight months later

Case 3 —E A , a woman age 45, for a year had had intermittent pain in the right side of the abdomen   There was tenderness at this point, extending upwards from the right iliac fossa to the right costal margin, and to the loin behind   No tumour could be felt   Pyelogram taken (*Fig* 492)   At operation there was a dis-   ie ureteropelvic junction which was
and sewn up transversely, followed by a nephropexy   Some leakage from the fourth to the tenth day of convalescence   One year later she was quite well, and had had no further symptoms
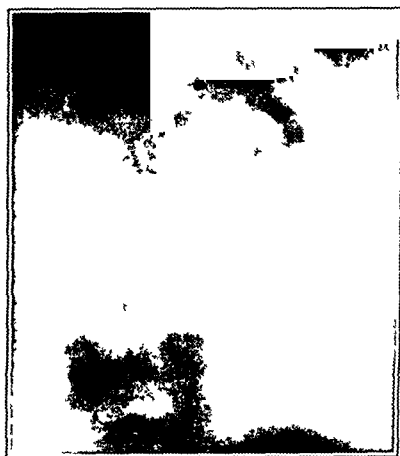
What is common to these three selected cases and what impresses itself so forcibly upon an operator who is entrusted with the management of hydronephroses belonging to these groups, is the fact that there is not sufficient mechanical narrowing of the kidney excretory duct to account for urinary retention of such degree   The artery in the first patient had existed in its abnormal position since birth, and the mobility in *Case* 2 was in all probability of long duration   Why then, if these agents accounted for the hydronephrotic condition did the lesion not manifest itself until the age of twenty years in *Case* 1, and sixty-two in *Case* 2 ? The same pertinent question may be asked about the third patient if the narrowing at the uretero pelvic

FIG 492 —*Case* 2

junction be regarded as a congenital and not as an acquired formation   The answer is to be found in the study of the anatomy and physiology of the pelvis and ureter

I ANATOMY AND PHYSIOLOGY OF THE PELVIS AND URETER

Anatomy—The anatomy of the kidney pelvis has been studied by Hyrtl, Papin Legueu, Disse, by dissection, and by taking casts of this structure when distended after death   It has also been investigated by radiography after filling the renal pelvis with an opaque fluid, in excised kidneys, and by pyelography during life   The last method probably gives a truer picture of the shape of the living pelvis, whose muscular walls have a tone of their own and so influence its conformation   but the method cannot be employed systematically in healthy individuals, and, indeed we obtain pictures of distended normal living pelves only when a wrong diagnosis has been made and a suspected

renal lesion is proved by pyelography to be a lesion of some other organ   But the knowledge thus gained serves to check observations made after death Typically we may say that, on being traced upwards, the ureter expands into a funnel-shaped structure which soon divides into two segments or primary calices   The upper oblique one carries on the line of the ureter   the lower one branches off more or less horizontally   The oblique calyx is long and thin, often with a constriction in its middle , the horizontal one is short and stumpy   Each primary calyx has opening into it calices of the second order   Branching does not proceed beyond this usually   Sometimes there is a third primary calyx   Really this is an unusually large secondary calyx which opens into the

FIG 493   Normal type

horizontal calyx, occasionally into the bifurcation between the two primary calices or exceptionally into the upper calyx

The arrangement and form of the pelvis and calices, however shows a very wide range of variation from the standard type which is shown in *Fig* 493   Thus the pelvis may be very small the ureter appearing to split almost directly into two primary calices

(*Fig* 494) In other cases the pelvis is large and the calices are sessile in their insertion (*Fig* 495) An ampullary form of pelvis is described (Braasch, Papin) If such a variety is truly normal, it is very difficult to distinguish it from the early stage of hydronephrosis This aspect of the anatomy of the renal pelvis will be returned to again when the diagnosis of pelvic abnormalities is considered

The ureter is not of uniform calibre along its length there are three narrowed areas, between which are two fusiform segments called the lumbar and pelvic ureteric spindles The lowest constriction is at the vesical orifice, the middle one at the point where the ureter crosses the iliac vessels The uppermost narrowing is variable in position sometimes it is situated at the junction of the pelvis and ureter, but in other individuals it lies four or more centimetres below the upper end of the ureter, which is funnel-shaped, but yet quite distinct from the renal pelvis (*Fig* 493) A fourth constriction has been described as present in some women where the uterine artery crosses the ureter These narrowings of the ureter are not present in quadrupeds, but appear in the orthograde apes

FIG 494 —Normal pelvis bifid type
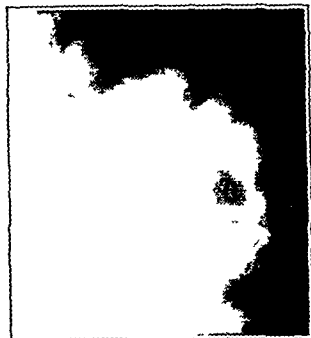
FIG 495 —Normal pelvis with sessile calices

The descriptions of the structure of the wall of the ureter vary very much, and there is scarcely any reference to the structure of the pelvic wall Thus, Kolliker describes an external longitudinal coat and an internal circular coat in the upper two-thirds of the ureter, in the lower one-third another longitudinal coat internal to the circular one Henle describes an outer circular, and an internal longitudinal, layer Disse maintains there are three coats all along, two longitudinal layers with a circular one between them

My own investigations agree with the description of Bohm, Davidoff, and Huber In the middle and upper regions of the ureter there is a thick longitudinal layer with a thin external circular layer In the lower one-third another and much less uniform longitudinal layer appears outside the circular layer This is the structure in the adult Immediately after birth, sections show that the muscular fibres are arranged chiefly concentrically, with the lumen of the ureter only a few longitudinal bundles are seen Serial sections have demonstrated that these longitudinally-running bundles are circular ones which have bent in towards the lumen and turned either upwards or downwards The muscular layers are not nearly so regular in the direction of their fibres, nor so distinct from one another as in the alimentary canal

The muscular wall of the pelvis of the kidney is thinner than that of the ureter and the bundles of fibres interlace in all directions There is no demonstrable anatomic sphincter at the junction of the pelvis with the ureter

The nerves for the pelvis and upper ureter come from the spermatic plexus, those for the lower ureter from the hypogastric plexus They are all non-medullated A plexus is formed under the outer fibrous tunic, but ganglion cells are only found at the two extremities of the duct From the plexus fibres go to the muscular coat and the mucosa

Physiology—The ureter is not a passive channel conveying urine from the kidney towards the bladder   It has an activity of its own forcing the urine along by peristaltic contractions, not continuously, but intermittently and with a rhythm more or less constant   This muscular contraction was first studied by Englemann in rabbits cats, and dogs, in 1869, and although many others have also investigated it the physiological mechanism is still far from clear   A rather pretty demonstration of ureteric peristalsis can be given by inserting a long needle from the skin surface through the convex border of the kidney into the pelvis of an anæsthetized rabbit (urethane), and injecting 13 per cent sodium iodide whilst the animal is observed under the x rays   The opaque fluid is seen to fill out the pelvis and to be passed by vigorous waves down the ureter

The method of excitation and the factors influencing ureteric activity remain in doubt   because experiments have given such equivocal, and sometimes opposite, results in the hands of different observers   Certainly the frequency of contractions of the ureter has no very close relation with the volume of urine secreted in a given time   This can be established by simple inspection in cases of exstrophy of the bladder   The jet of urine is more or less abundant according to circumstances   There is a certain increase in the frequency of expulsion when the secretion of urine is more profuse   but the rate of contraction is not to be hurried beyond a certain point   As Englemann showed, there is a refractory period to stimulation   In the normal bladder it is found by observation with the cystoscope that peristaltic contractions take place at somewhat irregular intervals About twenty seconds is a very usual period to elapse between two ureteric discharges but often there will be a long pause of several minutes , or again, the ejaculation of urine may take place five times in a minute   These variations seem to depend upon nervous reflexes, powerful amongst which are those set up by the necessary instrumentation   The rhythmical power of contraction appears to be a property inherent in the ureter just as it is in the heart   and, like this organ, it is not necessary that fluid should be propelled in order that contractions may take place , for if the pelvis of the kidney be severed from the ureter experimentally, peristalsis continues to take place in this latter structure unaltered   Moreover I have observed by cystoscopy the vesical portion of the ureter to contract months after a nephrectomy had been performed   This innate tendency to rhythmical muscular contraction is exhibited well by excised ring preparations of ureteric segments in Locke's solution   D I Macht, in particular has investigated the properties of ureteric muscle in animals and man by this method   He found that ureteric muscle contracts better if a little urine is added to the Locke's solution or if the solution is slightly acid   I cannot agree with him that this approaches the conditions existing in the body   The muscular wall of the ureter is never bathed during life by urine or an acid fluid   These two factors can only act through the medium of nerves in the mucous membrane   Macht also showed that epinephrin stimulates ureteric peristalsis in the pig's ureter, and if in sufficient concentration, causes it to go into tetanic spasm

Fig 496 is a tracing obtained from two rings of muscle, one from above the uretero pelvic junction, and one from the ureter just below, cut from the excised kidney of a man Simple Locke's solution oxygenated, and at body temperature, was used   After one hour and a quarter the ureteric ring began to contract spontaneously, two contractions at a time, at long intervals   But the addition of adrenalin caused regular and more frequent contractions to take place until, apparently the muscle was exhausted   There was no tendency to tetanus   The lower tracing is from the pelvis   No spontaneous contractions occurred in this but adrenalin acted as a stimulus and there was regular movement of the lever   These contractions took place at a rate nearly twice that of the ureter It is clear that the pelvis has an innate tendency to rhythmic contractions just as has the ureter   and it is equally interesting that a normal constituent of the blood (epinephrin) acts as in excitant of ureteric contraction

Whilst peristalsis of the ureter appears to arise in this structure itself, it is very much under the influence of extrinsic nervous impulses   Opening the abdomen seems to inhibit peristalsis of the ureter just as it does of the intestinal wall   and no cystoscopist can doubt

the influence of his manipulations upon ureteric activity   Section of the splanchnics in my hands has given conflicting results, no doubt because the experiment, owing to the operation of factors unknown, could not be reduced to its simplest terms

Protopopow found that stimulation of the peripheral end of the splanchnics led to acceleration and strengthening of contractions, whilst Stern sometimes got augmentation, but usually inhibition   Probably there are both kinds of nerve fibres running in the splanchnics

Dissimilar Functions of the Renal Pelvis and Ureter.—A very cursory consideration of the salient facts of renal secretion and discharge leads us to the conclusion that these two divisions of the kidney duct are separate functional entities   That the passage of urine down the renal tubules into the pelvis is continuous is a simple fact of physiology, that the passage of urine from the ureter into the bladder is an intermittent process is an every-day cystoscopic observation   How is it that a continuous trickle into one end of the duct becomes an interrupted efflux from the other?   The explanation resides in the fact that the pelvis acts as a temporary reservoir for the secreted urine, being separated

Upper end ureter

Pelvis

½ minutes

↑ = 10 drops 1 1000 adrenalin added to 25 c c Locke
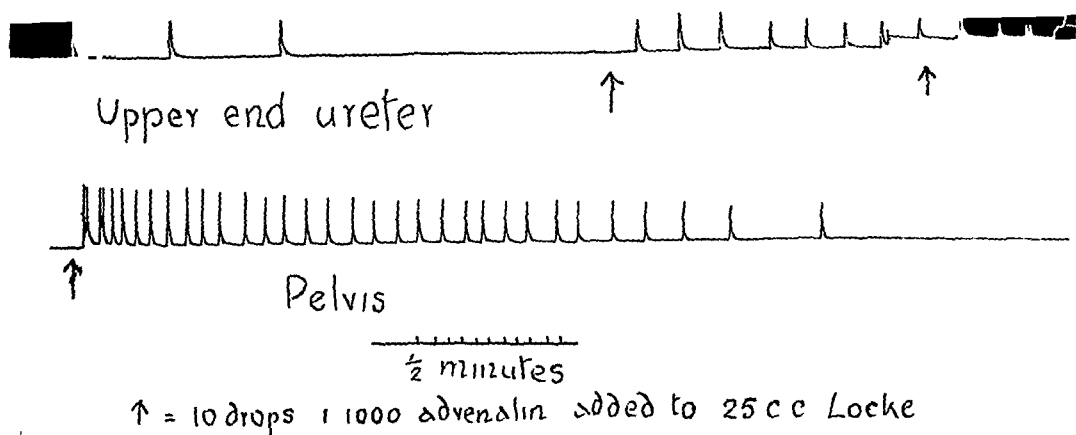
Fig 196

from the ureter by muscular contraction at the ureteropelvic junction   At certain intervals the pelvis contracts, and with this contraction there is a relaxation at the ureteropelvic junction, urine passes into the ureter and is carried onwards by a true peristaltic wave

Confirmatory evidence has been sought to test the truth of this conception of a uretero-pelvic sphincter   A rabbit was anæsthetized with chloral and the ureters were exposed by a median laparotomy   Peristalsis was observed taking place in each of them   The bladder having been opened a small glass cannula was introduced into the left ureter and Locke's solution allowed to trickle in under low hydrostatic pressure   The ureter was seen to dilate gradually, and peristalsis to weaken   Finally, the dilated ureter ceased to contract at all, but the dilatation stopped at the ureteropelvic junction

I have also obtained evidence of a local sphincteric action at this point by inserting a fine cannula through the convex border of the kidney into the pelvis   In one experiment the pelvis distended without the ureter   in others, over-distention of pelvis and ureter was followed by a localized spasm at the uretero-pelvic junction *

John Caulk has recently described a case of hydro-ureter due to constriction of the ureter close to the bladder   The ureter was enormously dilated   it measured one and a half inches in diameter from the bladder to the kidney pelvis   and contained eight

* Certain factors the nature of which I have been unable to determine sometimes interfere with this reaction   It is easier to check the spasm by distension from above than by injection from below

ounces of urine   Pyelograms showed that there was not the slightest dilatation of the renal pelvis   After incision of its vesical orifice the uretei returned to its proper calibre and exhibited normal peristalsis   This is a pretty demonstration of a ureteropelvic sphincter—though not recognized as such by Caulk   The pyelogram (*Fig* 497) I think also tends to support this view   The catheter discharging opaque fluid into the ureter has distended the upper segment of this channel and passed thence through the ureteric sphincter, spasmodically contracted round a stone into the renal pelvis   At operation the ureteric wall at the site of impaction of the calculus was unaltered apparently, and the fact that urine could escape and the opaque fluid gain entrance past the stone shows that the constriction seen in the pyelogram is spasmodic in nature

That there are such cases of hydronephrosis as that cited at the beginning of this thesis where at operation a fair-sized bougie would pass easily down to the bladder, the pelvis of the kidney alone being distended, is evidence of a distinction of function between the two segments of the kidney duct

Fig 497 —Showing spasm round a stone at the uretero pelvic junction

II   THE BEARING OF THE FOREGOING DATA UPON THE CONCEPTION OF THE GENESIS OF HYDRONEPHROSIS

If we keep in mind the physiological mechanism by which urine is transferred from the kidney to the bladder, we shall be able to realize how disturbances of this mechanism or of its relation to renal function, may throw such a strain upon the renal pelvis that dilatation will result   Let us suppose that a continued polyuria takes place, so that during a given time, urine flows into the pelvis in quantity beyond the normal limits   Remembering that this structure tends to contract at definite intervals , that its rhythm is not to be hurried beyond a certain point, being largely independent of the tension of its walls   and that it is functionally separated from the ureter by a sphincter , t can readily be seen that the pelvis may be unable to transfer to the ureter as much urine is flows into it from the kidney   It must, then perforce dilate   Dilatation from over distention would take place more easily in the pelvis than in the ureter because of its thinner muscular walls   This is no mere hypothesis without foundation   Hydronephrosis without demonstrable mechanical obstruction is well known to occur in diabetes, and Thomson Walker has observed that the attacks of pain in primary hydronephrosis, which are due to a rapid temporary distention of the renal pelvis, are likely to occur after large quantities of fluid have been imbibed   But polyuria itself and unaided is probably a rare cause of hydronephrosis   An abetting cause is some obstruction at the ureteropelvic junction   The alleged causes of such hindrance at the pelvic outlet are impacted calculus, a congenital valve, kinking, stricture, and an abnormal renal artery   To these I would add spasm , whether this is due to irritation of the kidney or pelvic wall—perhaps by some change in the composition of the urine—or to an extrinsic nervous reflex, I am unable to say

The Dietl's crises of the dropped kidney or the strictured ureter can be explained in their intermittency by the two contributory causes polyuria and ureteropelvic sphincteric spasm acting either alone or in combination   That the obscure cases of hydronephrosis without mechanical narrowing have a similar origin would now seem to be clear and their genesis understandable

Abnormal Narrowing at the Ureteropelvic Junction as a Cause of Hydronephrosis — Amongst the cases met with clinically, this is the commonest cause of

obstruction at the upper extremity of the ureter   The hydronephrosis due to it rarely comes on until adult life is reached   This fact has been regarded as a difficulty in accepting the stricture as having a developmental origin, as being an exaggeration of that local failure to increase in calibre which is a normal phenomenon of ureteric growth Geraghty and Frontz maintain that there are always to be found signs of an old inflammatory process in the ureteric wall if a careful examination is made   I cannot agree with this statement   Sections were made by Dr E H Kettle of the strictured part of the ureter in a specimen of a large hydronephrosis which I removed   He reported that there were no histological signs of the fibrosis of repair in the ureteric wall   I have cut another specimen   it also fails to show evidence of a previous inflammatory process It seems more correct to regard these strictures as developmental and not inflammatory, and this conclusion is more easy of acceptance in the light of the facts brought forward above, whereby it can be understood how the resulting hydronephrosis need not appear until late in life

Hydronephrosis due to an Abnormal Renal Vessel —I believe that the abnormal renal artery going to the lower pole of the kidney plays such a subordinate part in the production of hydronephrosis that it is doubtful whether it should be included in the list of causes of this condition   This vessel may run in front or behind the ureter, which may be found to be kinked over the vessel when the uronephrosis is exposed at operation   At a first glance it is tempting to suppose that the artery is the cause of the obstruction   A closer inspection frequently reveals the fact that the part of the ureter proximal to the kink is no more dilated than that part distal to it   This was so in the patient whose pyelogram is depicted in *Fig* 504 The abnormal artery and vein formed a very dense cord across the front of the ureter, which ran upwards from its origin to loop over them   The ascending part was adherent to the dilated pelvis   When these adhesions were divided and the ureter was straightened out the real obstruction was seen to be a narrowing at the ureteropelvic junction   The state of affairs was almost exactly that seen in *Fig* 498, which is from a specimen in the St Mary s Hospital museum   In such

FIG 498

patients obviously the uronephrosis forms first, and the distended pelvis enlarging downwards carries the commencement of the ureter with it, thus bringing about the kinking over the abnormal vessels   The adhesions are secondary
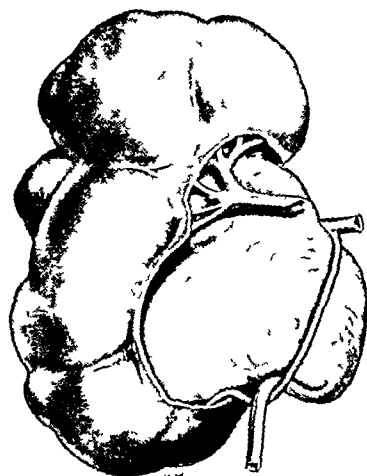
The Congenital Valve as a Cause of Hydronephrosis —The frequency of this fold at the upper ureteric aperture has been over-estimated   Probably it is a very rare cause of hydronephrosis, and I have been unable to find a specimen of it   It must not be confused with the secondary valve, the result of the hydronephrosis itself   Once formed, the latter is a great obstructing factor but it is not the originator of the hydronephrosis

Nephroptosis as a Cause of Hydronephrosis —A movable kidney is not uncommonly associated with hydronephrosis, and in pyelograms the upper end of the ureter is usually found to be curved   A double bend is most characteristic   These kinks are commonly supposed to be the cause o the hydronephrosis, but the pathology is not so simple as this   In the first place the kinks are not sufficiently acute   A very sharp bend is necessary to obstruct a muscular tube such as the ureter , for though there may be some resistance due to the kink when a peristaltic wave forces fluid along it there is a tendency for the ureter to be straightened out, just as a bent rubber tube uncurls with the forcible passage of water through it   Should the bend in the ureter be fixed by adhesions this facilitation by straightening cannot take place   Such kinks are found

but not very commonly An approximation to this condition however, probably occurs in the movable kidney The partial obliteration of a kink at the ureteropelvic junction might only be possible by a slight elevation of the dropped kidney, for which the propulsive force of the pelvic contraction is ludicrously inadequate The kink is potentially fixed by the weight of the kidney But admitting such an etiology, there are still a number of cases to be accounted for in which the bends are not acute enough to cause obstruction In these I suggest there is a spasm at the ureteropelvic junction set up reflexly by a dragging on the renal plexus On this hypothesis the conditions found in *Case* 2, cited above, and the resulting cure by operation, can be explained The pyelogram of a similar case in a girl, age 24, is shown in *Fig* 499

FIG 499 —Obstruction caused by spasm at uretero-pelvic junction in an abnormally movable kidney
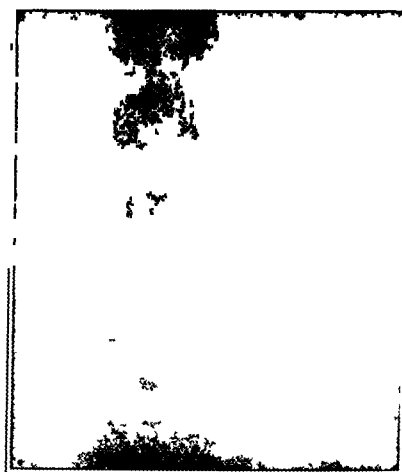
FIG 500 —Obstruction caused by impacted stone

Impacted Calculus as a Cause of Hydronephrosis —This is a very common cause, the stone becoming lodged in the naturally narrow ureteropelvic junction The intermittent obstruction necessary for the production of the uronephrosis is due to a variation in the spasm of the ureteric wall at the site of impaction which I have shown takes place under these circumstances (*Figs* 497 and 500)

Other Causes of Hydronephrosis at the Ureteropelvic Junction —A calculus after lodging at this point may pass, leaving behind it an ulcer which, cicatrizing, produces an inflammatory fibrous stricture Hydronephrosis will result A periureteritis may infiltrate the wall of the ureter, rendering it rigid or actually narrowing it, in both cases causing an obstruction A very unusual state of affairs was that in a man admitted to St Mary's Hospital last year with a large swelling in the left side of his abdomen At the operation a hypernephroma was found in the left kidney The large hydronephrosis was due to the growth plugging the ureter

III THE CLINICAL FEATURES OF EARLY HYDRONEPHROSIS

Characteristically in early stages, hydronephrosis is accompanied by attacks of pain which correspond to the periods of greater distention The pain is acute and is often referred first to the iliac fossa Nearly always it is felt also in the loin , much less often it radiates to the outer side of the thigh or genitals Vomiting occurs after the onset of the pain The pulse and temperature may be raised There may be superficial tenderness in the iliac fossa but deep tenderness is found in the renal angle behind and under the costal margin in front unless the kidney is situated lower A tumour is by no means always to be felt, as it is often under the ribs and inaccessible, it or the time of the

examination the hydronephrosis may be empty and the sac collapsed The urinary signs are very inconstant and very often lacking They are frequency with scanty urine during the attack, and a polyuria afterwards As a rule these attacks are not accompanied by renal haemorrhage and there is no alteration in the urine

A rare first symptom is haematuria A lady, age 48, had for some months complained of pain in the left side of the back and abdomen The pain was not acute nor in attacks One day she passed a large quantity of blood in the urine without pain A skiagram did not reveal a stone There was no tumour to be felt in the abdomen when I cystoscoped her a few days later, and the bladder and ureteric orifices were normal in appearance, the effluces being quite clear A few weeks later another profuse haematuria occurred, and it was only wit much irrigation that a view of the interior of the bladder could be obtained the haemorrhage was then seen to be pouring out of the left ureteric orifice A diagnosis of renal growth was made but at the operation the kidney was discovered to be simply a collapsed flaccid hydronephrosis The cause of the hydronephrosis was a narrowing at the ureteropelvic junction, but the aperture was not of very narrow calibre and was freely permeable

IV THE DIAGNOSIS OF EARLY HYDRONEPHROSIS

The symptoms described, apart from the presence of a renal tumour, will justify the surgeon in doing no more than suspect the presence of early renal retention Confirmation can be obtained only by cystoscopy and pyelography On cystoscopy the bladder usually has a normal appearance Fenwick described a lengthening of the ureteric slit on the side of the hydronephrosis, but this is not a sign upon the absence of which any reliance can be placed The ureteric orifice may appear absolutely normal There may be no efflux at all if the hydronephrosis is closed but frequently the ureter is seen to be discharging in the usual fashion, especially in the intermittent cases A catheter should be passed up the ureter This instrument may be arrested at the site of the obstruction but this is by no means always the case Very often it will be possible to penetrate through the narrowed portion to the pelvis Care must be taken not to diagnose a stricture of the ureter at a site where no pathological constriction exists In women especially the point of the catheter is apt to be brought to a standstill at the level of the iliac vessels, and less often at the point where the uterine artery crosses the ureter A smaller-sized catheter (No 5 instead of No 6) will almost always get through When the catheter reaches the pelvis, urine flows out in continuous drops, and a large quantity is collected in a short time This will almost suffice to complete the diagnosis There is one other sign When the pelvis is empty, saline may be allowed to run in a large quantity can be instilled into the pelvis before the conscious patient will complain of pain But this is no reliable measure of the capacity of the renal pelvis, for the fluid can escape easily beside the small sized catheter into the bladder When the pelvis is not dilated the tension in it soon rises, so that pain is quickly complained of A pelvis which has been repeatedly stretched by attacks of retention can be distended without pain to a degree far greater than a normal pelvis will tolerate Pyelography, however, gives the best information as to the size and conformation of the pelvis In studying the radiographs it is very necessary to have a mental picture of the various forms which the normal pelvis assumes and again it is essential to know what constitutes a deviation from the normal When the distention is of moderate or great degree there can be no hesitation in coming to a conclusion that the condition is pathological but in early cases it is not always easy to decide Three deviations from the normal shadow have been emphasized as characteristic of early hydronephrosis They are (1) Broadening of the bases of the larger calices , (2) Clubbing of the extremities of the calices , and (3) Sagging of the lower border of the pelvis

The broadening of the necks of the calices (see Fig 506) is a reliable sign, but considerable dilatation can take place without its being present as can be seen by reference to Fig 509 This shadow is very characteristic of a certain form of hydronephrosis in which

the brunt of the back-pressure seems to fall upon the calices, the pelvis retaining its normal shape and size   In the unaltered kidney the extremities of the shadows of the calices present an indentation due to the projections of the apices of the pyramids   In hydro nephrosis the pyramids become flattened, and in consequence, the corresponding indenta tions in the calical shadows disappear   Fig 491 is a good example   But too much stress has been laid upon this sign as indicative of early hydronephrosis   One has only to to examine kidneys removed post mortem where there is evident hydronephrosis to be convinced that the obliteration of the projections of the apices of the pyramids into the terminal cali es is not an early sign   A glance at Fig 506 will also show that this is so The sagging of the lower border of the pelvic outline is seen in Figs 504 and 506   But, again, this is not present in the large hydronephrosis in Fig 491 nor in Fig 492   I should like to call attention to another deviation in the outline of the pelvic shadow which I think is never seen in the normal   It is a bulging of the inner side of the pelvis towards the spine, beginning at the upper end of the ureter   With the inner border of the pelvis the emerging ureter forms an angle open towards the spine   A normal pelvic shadow on its inner border runs directly into the ureter almost in a straight line (Fig 495), or makes an angle in the opposite direction (Figs 493 and 494)   This bulging of the inner wall of the pelvis with an angle open towards the spine is seen in Figs 506, 492 497, and 504   It is a valuable and reliable sign   It is also I think, what those writers mean who talk about an alteration in the angle of insertion of the ureter   It is not the ureter that is at fault but a pathological bulging inwards of the pelvis
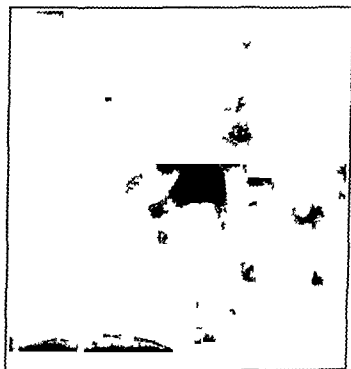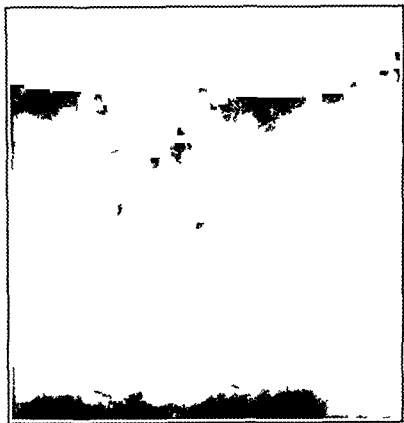
Figs 501 502 —To illustrate the difficulty in reading pyelograms

I should like now to direct attention to Figs 501 and 502, because they demonstrate well the difficulty in interpreting pyelograms   In Fig 501 it will be seen that there is the bulge towards the spine beginning, and a certain broadening of the bases of the calices Is this an early case of hydronephrosis ?   Many authorities might regard this shadow as not transgressing the normal limits, but I am not so certain of this   The patient had had attacks of right sided pain which were supposed to be appendicular   I did not think the pyelograph justified cutting down on the kidney   A surgeon operated and removed in appendix which showed no trace of disease inside or out   No other abnormality in the abdomen or pelvis was discovered   Fig 502 is a shadow in a woman who had repeated attacks of pain in the back and left side   The necks of the calices are still narrow, but there is an absence of indentations into the calices, and the upper group turned forwards (or backwards) seem to form a larger shadow than should normally be there   The lower border of the pelvic shadow shows the beginning of sagging   Here again I was uncertain and decided against exploratory operation   I hope to follow the further history of these two patients

As in other instrumental aids to diagnosis when considering the pyelogram, and

judging whether or not the shadow is pathological in shape, due weight must be given to the clinical history The pelvis is variable in outline within considerable limits , and it is not always easy for the radiographer to say when these boundaries have been transgressed Under such circumstances a careful review of the symptoms must be made These, if ambiguous, will point to the necessity of later study of the case in the event of their recurrence, but if distinctive will confirm the suspicions aroused by the radiogram

Difficulty in diagnosis of early hydronephrosis is most likely to occur when it is the right kidney which is affected, for in this case it must be distinguished from appendicitis cholecystitis, and torsion of a mobile cæcum A careful consideration of the history of the attacks will lead the surgeon to suspect one or other condition , but if consulted between attacks, physical signs may be absolutely lacking in an ordinary clinical examination Particularly confusing is the story of attacks of torsion of a prolapsed mobile cæcum for there is a history of a lump appearing in the abdomen which goes with the cessation of the pain This tumour, however, is lower than the usual kidney swelling There is no pain in the back If seen during the attack the nature of the swelling is evident it is tense, resonant, and perhaps varies in hardness with peristaltic contractions of the cæcal wall

THE TECHNIQUE OF PYELOGRAPHY

The obtaining of successful pyelograms requires meticulous care in following out the details of a rather complicated technique The patient, radiologist, and surgeon must all co operate Several questions have to be decided They are (1) The choice of the solution for injection , (2) The pressure under which this solution should be injected , (3) The anæsthetic to be used , (4) The position of the patient , and (5) The radiographic technique

In the past a number of different substances have been used for injection—argyrol collargol, cargentos, silver iodide, and thorium nitrate I have used and obtained good shadows with argyrol, collargol, and thorium citrate Of these, Braasch's researches have shown thorium citrate solution to be the least harmful to the kidney substance but the shadows with it are not quite so good as with silver salts, and it is rather troublesome to prepare Fortunately, solutions of both sodium iodide and bromide are innocuous and give excellent shadows The careful work of Cameron has shown that a molar solution of sodium iodide (13 5 per cent), a $\frac{1}{10}$ molar solution of thorium citrate (15 per cent), and a 3-molar solution of sodium bromide (25 2 per cent) have the same opacity to x rays The harmlessness of sodium iodide or bromide solutions was demonstrated by retaining them in the kidney pelves of dogs at kidney secretory pressure for twenty-five minutes afterwards no alteration in the blood urea and nitrogen estimations was found, and phenolsulphonephthalein was excreted in normal fashion Again, intravenous injections of large doses of sodium bromide or iodide produced no effects Potassium bromide or iodide, however, is very toxic on injection The viscosity of the sodium iodide solution is less than that of the other two solutions, and its osmotic pressure is very much nearer that of urine Thus a molar solution of sodium iodide is the fluid of choice It is made by dissolving 15 grm of sodium iodide in 100 c c of water

*The Pressure under which the Opaque Fluid should be Injected —*It has been proved by operations upon kidneys which have been injected shortly before, that very serious damage can be done by pyelography Usually it has been found that the injection fluid has passed up the collecting tubules into the kidney substance It has ruptured the delicate secreting tubes and extravasated under the capsule of the kidney This mechanical damage results from injecting the pelvis under too high a pressure Further injury is done when the injection fluid is an irritant such as collargol It is clear therefore that the pressure for injection should be less than the secretory pressure of the kidney cells so that the fluid entering the pelvis cannot pass up the secretory tubules Now Stirling has shown that when the ureter is obstructed the kidney ceases to secrete urine when the pressure in the pelvis reaches a point about 50 mm of mercury short of

the blood-pressure   This would be approximately 60 to 70 mm of mercury   Howell states that the pressure in the renal pelvis that will stop renal secretion is 40 to 50 mm of mercury   The pressure for injection must not rise, then, above 35 to 40 mm of mercury

An Apparatus for Injecting the Renal Pelvis—I have employed the contrivance shown in *Fig* 503 as a convenient and safe instru ment for filling the renal pelvis   The solution of sodium iodide is contained in the graduated tube *A* to which is attached below a piece of rubber tubing ending in a tapering nozzle which fits into the end of a fine ureteric catheter   This part of the apparatus can be boiled   Above, the tube is closed by a rubber bung through which passes the stem of a T-tube   One limb of this is connected with a manometer *B* which shows the operator under what pressure the sodium iodide solution is being expelled   This expulsion is brought about by means of the bellows *C* in communi cation with the other limb of the T-tube   Beyond the manometer is a mercury safety-valve *D*   By sliding the tube *E* up or down in its bung, the pressure of the air above the solution in tube *A* may be prevented from rising above any desired point   Above the mer cury in tube *D* is a layer of water   The object of this is to damp the movement of the mercury   If it is not there, whenever air escapes through the valve the mercury is broken up into minute globules which are expelled with great force, and even find their way out of the vent in the bung   The valve should be arranged to blow off when the mano meter registers between 30 and 40 mm of mercury pressure

Fig 503 —An apparatus for pyelography

Anæsthesia in Pyelography—The patient, having been purged to prepare him for radiography, is cystoscoped under general or local anæsthesia   Local anæsthesia may be employed for cystoscoping most women and some men, but it should be more widely recognized that cystoscopy in a certain number of men, especially young highly strung men cannot be done entirely painlessly with our present method of applying the local anæsthetic and the procedure is almost intolerable to others   It is characteristic, how ever of the urethra that it easily becomes tolerant to instrumentation   When a patient is used to the passage of bougies a cystoscopy can nearly always be performed on him with the very least inconvenience   A general anæsthetic is indicated in intolerant patients and I have also used it for young adult women in whom cystoscopy during consciousness is likely to cause mental distress   If general anæsthesia is employed the very least that is necessary should be given, and the operation conducted expeditiously in order that the patient may quickly return to consciousness for the skiagram   This is necessary, not that there is any danger of over-distension and injury—with my apparatus there is none— but because it is essential for the patient to hold his breath during the exposure so that the kidney may be still   Only in this way can a good shadow be obtained   The x-ray tube having been placed in position above the patient, and a plate beneath him   the fluid is injected at 30 to 40 mm of mercury pressure   As soon as he complains of any pain in the back or—in some cases of insensitive hydronephroses—when a considerable quantity has been injected the exposure is made   The catheter is allowed to remain *in situ* for a quarter of an hour to allow the fluid to drain out   There is no objection to administering a preliminary injection of omnopon ½ gr, or to giving tinct opii 20 min by mouth before the examination, if my apparatus is used   Morphine is not so useful in relaxing ureteric spasm

V THE TREATMENT OF HYDRONEPHROSIS

1 —Physiological Considerations which Influence Treatment

The choice of treatment lying between nephrectomy and some measure by which the kidney may be conserved, it is essential at the outset to determine two things (1) The presence of another healthy kidney , and (2) The functional power remaining to the affected organ   The first is established by cystoscopy   Accompanying every hydronephrosis there is always some chronic interstitial nephritis and failure of renal function By ureteric catheterization the power of concentrating urea, after the ingestion of this substance, or the excretion of phenolsulphonephthalein after injection, can be compared with the power possessed by the opposite healthy kidney   What percentage of urea will make it not worth while to preserve the kidney ?   Or   What diminution in percentage output of phenolsulphonephthalein will negative conservative measures ?   The answer to these questions cannot be given at present   Experience in treating cases of enlarged prostate has demonstrated that kidneys whose function has been very seriously damaged by having to secrete against pressure often evince a remarkable power of recovery when the mechanical resistance to secretion is removed, so that one should not be in haste to advise nephrectomy on the information obtained from renal-function tests alone   When in a case of hydronephrosis, the renal excretory function has been proved to be very depressed, the final decision whether nephrectomy shall or shall not be done will have to be made by visual estimation of the amount of renal tissue left, the organ having been exposed by operation   Braasch says that when the hydronephrosis contains more than 150 c c there is very little secretory tissue   Far too often it happens that the patient does not reach the surgeon for treatment until the kidney has been extensively and irreparably damaged, and the uronephrosis is of large size   Thus Simon, in 1914, found it only possible to perform conservative operations in three out of twenty cases, and this reflects approximately the position of affairs in this country hitherto   Now, however when in the early stages of pain without tumour it is possible to diagnose incipient cases, the proportion of conservative operations should rise considerably   At St Mary's Hospital during an interrupted period of three years, 15 cases of hydronephrosis (not including the two doubtful cases referred to on p 518) have come under my personal observation, and have been operated upon either by the senior surgeon to whom I correspond, or myself   Nephrectomy on account of the advanced degree of distention was only performed on 4 occasions   A fifth nephrectomy was done to remove an obstructing tumour   The other procedures carried out were nephropexy 3 pyelotomy for stone 2, pyeloplication 1, ureteropyeloplasty 3   One patient was not operated upon

The decision to perform a plastic operation having been reached, the question arises whether by removing the hindrance at the upper end of the ureter we have rendered conditions such that the dilated pelvis will shrink and recover its normal function   I think in view of physiological facts, we have not done sufficient unless we empty the pelvis at the operation and maintain it so for a considerable time   As we have seen the ureter will only convey a certain amount of fluid in a given time, and it is likely that with the pelvis distended and in the presence of polyuria, which so often accompanies the condition the ureteric mechanism may be insufficient ever to evacuate the pelvis the more so will this be the case should the pelvic musculature be paralyzed from over-stretching for then urine would enter the ureteric canal from the pelvic cavity only when the pressure in the latter became as great as the systolic pressure of a normal pelvic contraction   Therefore it would seem essential to drain the kidney pelvis after plastic operations not as some surgeons suggest because hæmorrhage may take place and obstruct the pelvic outlet but to allow of contraction and readjustment of the pelvic wall   I have no doubt this is an important factor in obtaining a successful outcome in plastic work though some authorities have recommended that drainage be discarded after for example ureteroplasty (W J Mayo Kross)   This is because surgeons have not studied the changes in the pelvis after operation by means of pyelography

C S , the patient whose pyelogram is seen in *Fig* 504, for two years had had inter mittent attacks of pain lasting about two days each which attacks came on finally at intervals of three or four weeks The capacity of the pelvis was 50 c c I performed a pelvi ureteral plastic operation upon her She healed without leakage Three months later she came to see me, saying that during the previous week on one occasion for a few
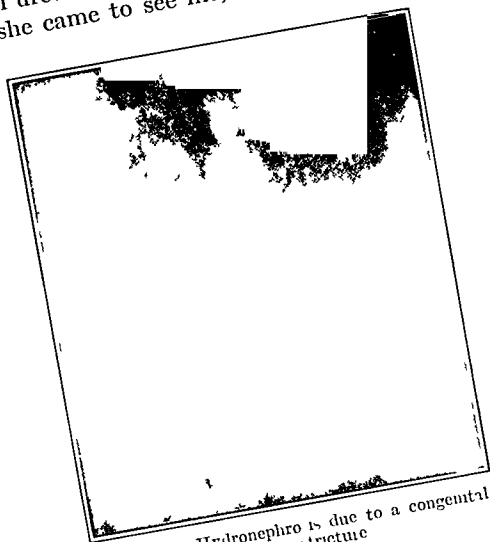
FIG 501 – Hydronephro is due to a congenital uretero pelvic stricture
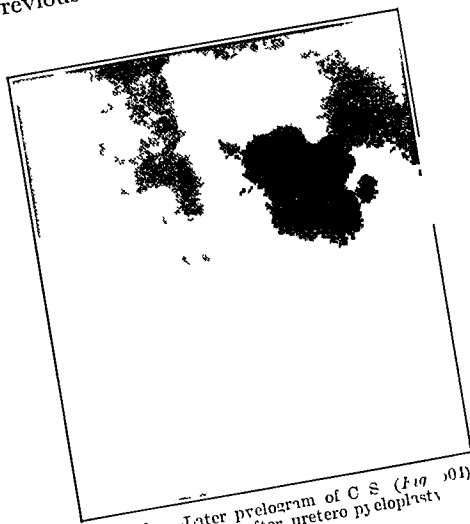
FIG 505 – Later pyelogram of C S (*Fig* 501) three months after uretero pyeloplasty

minutes, she had felt some pain referred to the outer side of her thigh a situation whence the p in had radiated in the original attacks On cystoscopy, the pelvis was found to contain 35 c c urine, and the pyelogram corroborated this (*Fig* 505) Comparing it with the condition before operation (*Fig* 501), it will be seen that the pelvis is not so globular, it has shrunk in size, and the lower calices are not so distended A comparison of the
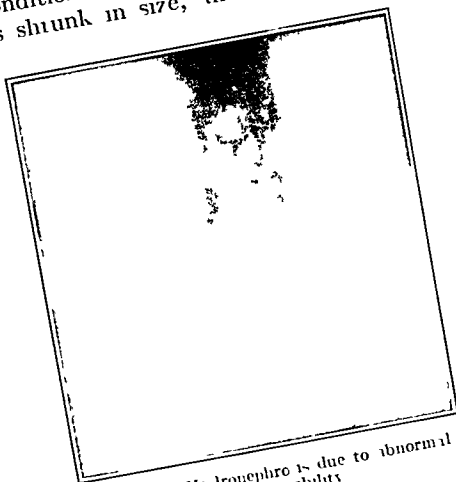
FIG — Hydronephro is due to abnormal renal mobility
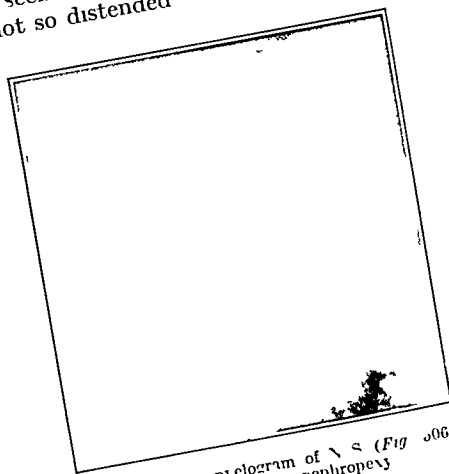
FIG 507 – Later pyelogram of N S (*Fig* 506) three months after nephropexy

upper calices is not possible because unfortunately in the pre operative pyelogram they are just outside the focus of the tube That more diminution in volume of the pelvis has not taken place is I believe, because, owing to the absence of post-operative drainage of the pelvis, this structure was never given a proper chance to contract down However, there is hope that the process of contraction will proceed It is significant

also that two other patients operated upon (ureteropyeloplasty), one by myself and one by Mr W H Clayton-Greene, after one year were absolutely without symptoms   A few days after the operation they both leaked urine for four and seven days respectively   This leakage probably served the purpose of drainage   My patient would not consent to examination by pyelography—she was a working woman who could not leave her business—and the other patient was inaccessible, so unfortunately I cannot present pyelograms of these cases   The following case is also pertinent to this question

N S   a girl, age 24, had had attacks of pain for seven years and recently had felt a lump in her left side   Fig 506 shows the size of the hydronephrosis   The lump was movable, but not excessively   There were no adhesions around the upper end of the ureter, and a full-sized bougie could be passed from the pelvis down the ureter into the bladder   Nephropexy alone was done   Three months later she returned   She had had no symptoms on the operated side and the kidney was firmly fixed, but she now complained of symptoms on the right side   The right kidney was found to be abnormally mobile   Pyelography was done on both sides   The left kidney pelvis is shown in Fig 507   Not very much contraction has taken place, but it can be seen that the necks of both the upper and lower major calices are narrower than before operation, whilst the pelvis is not quite so globular   The aperture made in the pelvis to pass bougies down the ureter healed without any leakage   This pelvis also should have been

FIG 505 —N S   Right kidney   Incipient hydro nephro is due to nephroptosis

drained to allow of shrinkage   In Fig 508 is shown the right kidney   A similar hydro-nephrotic change is taking place in this organ also

In cases of long-standing prostatic overflow incontinence, the bladder musculature is paralyzed by extreme distention, yet when a suprapubic opening has been made the viscus contracts down speedily, and regains its tone   It is not too much to hope that, with adequate drainage, the kidney pelvis would behave similarly

The need for drainage from another point of view is illustrated by Gregoire s case He performed a re-implantation of the ureter   Three days later a typical attack of renal pain occurred, with a swelling in the renal region which lasted four or five days and then disappeared   This he attributes to oedema at the suture line causing obstruction   A drain in the pelvis would have relieved the tension on the line of suture   He was able to show later, by cystoscopy, that the kidney operated upon was discharging urine into the bladder, though he does not give the ultimate size of the pelvis

If, at operation the kidney pelvis be made smaller by resection, return to normal will perhaps be facilitated, for the weight of urine necessary to fill a large pelvis will of itself put a strain upon the muscular wall   Operations of this kind have therefore a certain logical basis   Givec, two years after a resection of the pelvis was able to demonstrate by cystoscopy that the pelvis had remained small   Genouville and Leuret were able to do the same after a plication operation

B —Conservative Operative Measures and the Indications for them

These are —

1 Puncture and aspiration
2 Nephropexy
3 Division of an abnormal artery
4 Removal of an obstructing calculus
5 Ureteropyeloplasty   (i) Fenger, (ii) Bazy
6 Re implantation of the ureter   (i) Kuster, (ii) Delbet

7 Lateral pyelo ureterostomy (Albarran)

8 Pyeloplication (Israel, Albarran)

9 Resection of the pelvis   (i) Inferior (Albarran, Kummel)   (ii) Lateral (Thomson Walker)

10 V-shaped incision of a valve (Trendelenburg)

11 Hydronephrocystoneostomy (Schloffer)

12 Combinations of two or more of these procedures

Puncture of a hydronephrotic sac is the oldest treatment, and, curious to relate, occasionally has been followed by permanent cure   Thus Hue, in 1893 reported one case, well after seven years and Tillaux relates two others   The case of S W , referred to on p 509 is a cure after 20 years   One can only suggest that an ineffective nephro pexy was rendered effective owing to perinephritis set up by a little leakage of urine at the three tappings   Puncture can only cure where there is physiological without anatomical obstruction   It is an obsolete method
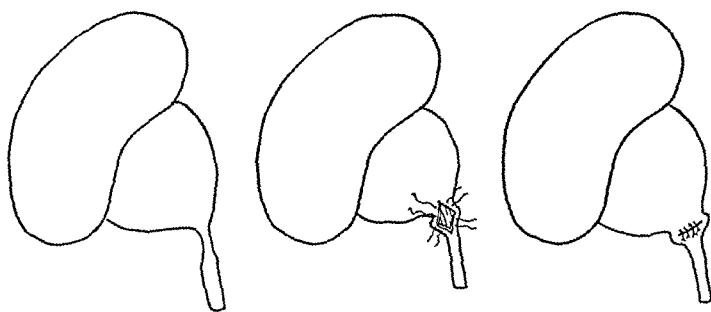
FIG 509 —Ureteropyeloplasty (Fenger s operation)
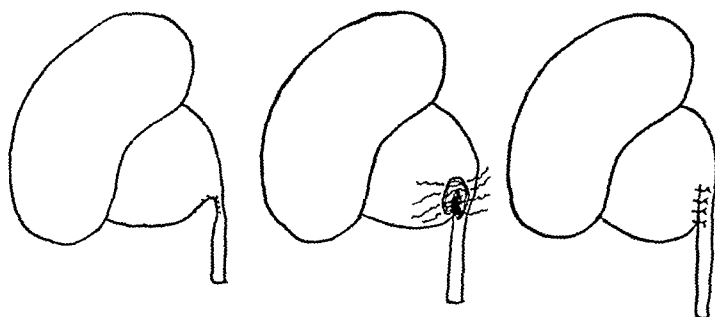
FIG 510 —Ureteropyeloplasty (Bazy s operation)

Nephropexy is the proper surgical treatment for cases of physiological obstruction accompanied by abnormal mobility   A small tube should be used for draining the pelvis It emerges from the wound made for the passage of bougies down the ureter   Nephropexy should also always be performed when any plastic operation has been done on the the renal pelvis

Division of an abnormal artery is insufficient treatment if my view of the insignificant part played by this structure is true   If divided at all a plastic operation or nephropexy must accompany it

Ureteropyeloplasty is the best operation when there is a congenital stricture and the wall of the ureter is not inflamed or fibrosed   The operation is simple (*Figs* 509, 510) Catgut should be the material used for the non-penetrating sutures, and a fatty fascial flap is sewn over the suture line   Pelvic drainage must be provided for by a special incision   Ureteropyeloplasty may be advantageously combined with resection of the lower part of the pelvis should the insertion of the ureter be very high

Re implantation of the ureter (Figs 511, 512), or *lateral anastomosis (Fig 513)*, is necessary when the upper part of the ureter is obliterated by disease   Drainage is necessary   Lateral anastomosis of the ureter to the lowest part of the pelvis is a
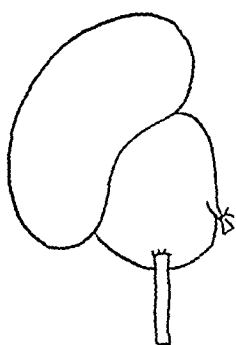
FIG 511.—Re-implantation of the ureter (Kuster s operation)
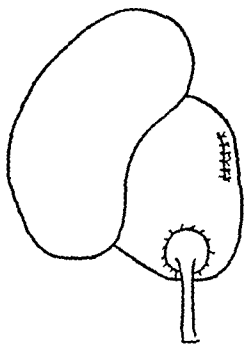
FIG 512.—Re implantation of the ureter (Delbet s operation)
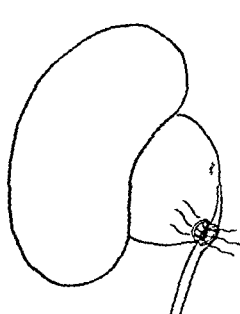
FIG 513.—Lateral anastomosis (Albarran s operation)
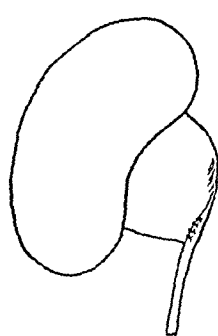
preferable operation, for there is muscular continuity preserved between the pelvis and ureter, whereby the co-ordination of pelvic contraction with ureteric peristalsis is uninterrupted

Pyeloplication (Fig 514), and *pelvic resection (Figs 515, 516)*, are indicated when the ureteric orifice is of good size but situated high   Drainage is necessary   These operations may supplement uretero-pyeloplasty
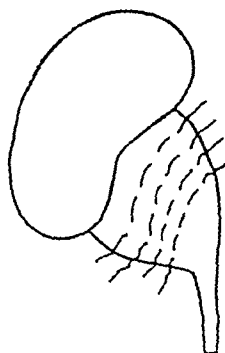
FIG 514.—Pyeloplication (Fradis operation)
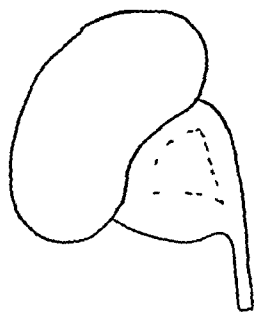
FIG 515.—Resection of pelvis (Thomson Walker s operation)
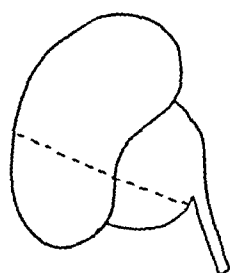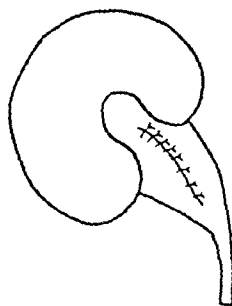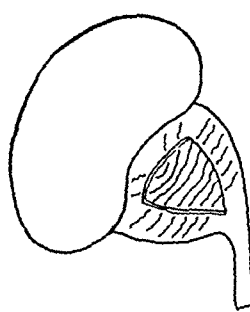
FIG 516.—Resection of pelvis (Albarran s operation)
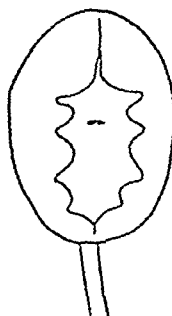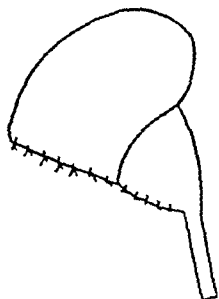
FIG 517.—V shaped incision of calyx (Trendelenburg operation)
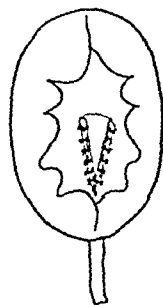
Division of the calices (Fig 517) is very satisfactory when this secondary valve formation has taken place   It is usually done through a nephrotomy wound   Drainage through the kidney is necessary

Hydronephrocystanastomosis —The formation of a communication between the renal pelvis and bladder is very rarely performed   Schloffer did this operation upon a woman with only one kidney which was hydronephrotic

VI THE RESULTS OF CONSERVATIVE OPERATIONS

Legueu has pointed out that published statistics of cure following plastic operations cannot always be relied upon as presenting an accurate picture of end-results   The disappearance and permanent absence of symptoms may, in fact, mean that the affected kidney has become obsolescent   Cystoscopy alone will show if the kidney functions Rufin s case demonstrates this fact   He performed a valve section combined with plication, and all symptoms disappeared , but six months later cystoscopy showed that the kidney was devoid of function   Legueu distinguishes between cures verified by cystoscopy and clinical successes   There is need for investigation of the end-results of plastic operations by pyelography   The largest series of end-results have been published by Kroiss in 1908 and Legueu in 1910   other end-results are scattered through the literature   The several operations had better be considered separately

URETEROPYELOPLASTY

No of Cases	Clinical Cures	Verified Cures	Reported by
26	20	—	Kroiss 1908
5	5	—	Mayo 1909
18	10	3	Legueu 1910
3	1	1	Simon 1914
Total 52	36	4	

= 77 per cent cured of all symptoms

To these may be added the three new cases reported above with two clinical cures, and one improved so much that it can practically be called a cure

RE-IMPLANTATION OF THE URETER

No of Cases	Clinical Cures	Verified Cures	Reported by
14	10	—	Kroiss 1908
3	3	—	Mayo 1909
12	8	2	Legueu, 1910
1	1	—	Thomson Walker 1911
2	—	2	Gayer 1912
1	—	1	Grégoire 1912
Total 30	22	5	

= 81 per cent cured of all symptoms

LATERAL ANASTOMOSIS

No of Cases	Clinical Cures	Reported by
11	7	Kroiss 1908

= 63 per cent cures

DIVISION OF A VALVE

No of Cases	Clinical Cures	Verified Cures	Reported By
10	8	—	Kroiss 1908
13	—	10	Legueu, 1910
1	—	—	Gayer, 1912
Total 24	8	10	

= 75 per cent cured of all symptoms

RESECTION OF PELVIS

No of Cases	Clinical Cures	Verified Cures	Reported By
6	6	—	Kroiss 1908
4	—	4	Albarran, 1909
4	1	3	Legueu 1910
3	2	—	Thomson Walker, 1911
9	—	9	Gayer, 1912
Total 26	9	16	

— 96 per cent cured of all symptoms

PYELOPLICATION

No of Cases	Clinical Cures	Verified Cures	Reported By
9	7	—	Kroiss, 1908
7	—	5	Albarran 1909
2	2	—	Legueu, 1910
1	—	1	Grenouville and Leuret 1912
Total 19	9	6	

= 78 per cent cured of all symptoms

COMBINED OPERATIONS

No of Cases	Clinical Cures	Verified Cures	Reported By
10	8	—	Kroiss 1908
1	—	1	Kroiss 1914
Total 11	8	1	

— 81 per cent cured of all symptoms

HYDRONEPHROCYSTANASTOMOSIS

Schloffer reports his case operated upon in 1906 as well in 1920, fourteen years later He shows pyelograms The bladder is drawn up locally towards the kidney pelvis which is still a considerable size This one would expect as it is subject to the force of contraction of the bladder during micturition

Reviewing the results of these plastic operations, it may be said that there is a very fair prospect of preserving functioning hydronephrotic kidneys by their aid When it is remembered that many of these successes were obtained at a time when diagnosis could only be made by the palpation of a tumour and the condition was necessarily advanced it will be appreciated that, with our modern methods of diagnosis, the outlook is still brighter in the future

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WISLOCKI and O CONNOR

MULTICENTRIC ORIGIN OF A RODENT ULCER.

By Sir G. Lenthal Cheatle, London

The main object of this article is to direct particular attention to the remarkable changes in the basal layers of the epidermis and hair follicles which occurred in the skin round a rodent ulcer. The skin was described by Mr Percy Legg as being infiltrated and not nodular.
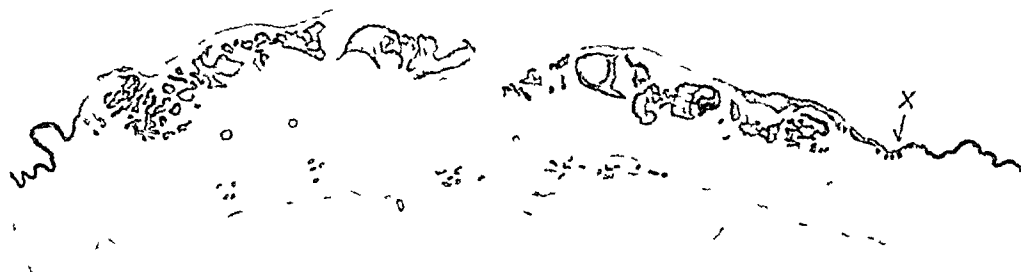
Fig. 18.—A bird's eye view of the rodent ulcer. Light or more deeply stained and isolated groups of cells are seen in the basal layer of the epidermis on the right of the ulcer. X indicates the portion shown in Fig. 18A.

Fig. 18A.—Two of the groups are seen under a higher power and are dipping into subjacent dermis, in which there are signs of chronic inflammation.

Fig. 19.—A bird's eye view of the 'infiltrated' skin at some distance from the ulcer in Fig. 18. X indicates the portion enlarged in Fig. 19A.

Fig. 19A.—Two foci of affected cells under a higher power. Two or three cells only are affected in the lower part of the drawing.

I must make it perfectly clear that these changes occurred in separated, isolated patches which were not in continuity with the rodent ulcer or with each other, and they were not pigmented.

Figs 518 and 519 are bird's eye views of the rodent ulcer and 'infiltrated' skin respectively   In these figures many darkly-stained, isolated, and small patches of cells are seen in the basal layer of epithelium , these are situated near the rodent ulcer in Fig 518, and at some distance from it in the 'infiltrated' skin in Fig 519   Fig 521, B shows the same appearances occurring in the basal layer of epithelium in a hair follicle

Under a high power the following changes may be observed   The pathological process appears to be a gradual one and occurs only in the basal layer of the epidermis and some hair follicles   Two or three epithelial cells stain more deeply than their neigh
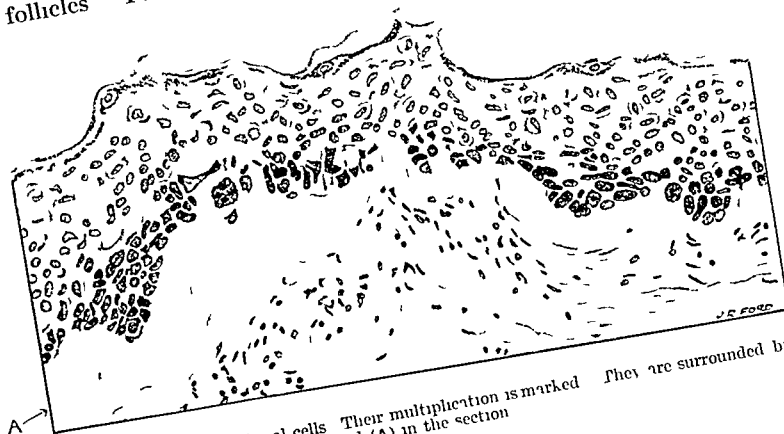
Fig 520 — A larger area of affected basal cells Their multiplication is marked   They are surrounded by coagulated fluid (A) in the section
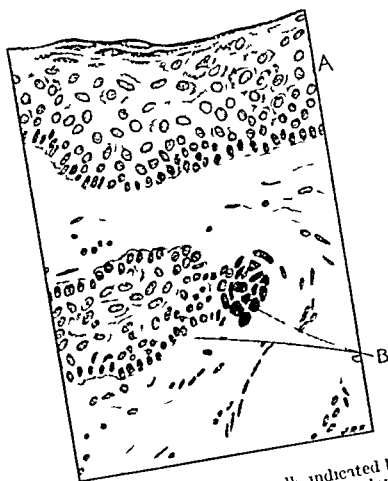
Fig 521 —The affected cells indicated by the upper line at B are in the basal layer of a hair follicle   A Epidermis
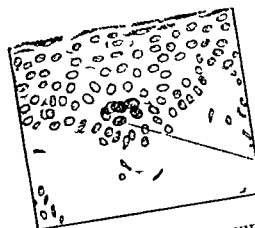
Fig 522 —Shows a group of alien cells at A above the basal layer in the epidermis taken one inch away from the edge of another rodent ulcer

bours, and are irregular in size and shape in the smallest lesions   (See Fig 519A)   A further stage exhibits eight or ten cells of the same appearances, but in addition they have multiplied, and penetrated into deeper structures   (See Figs 518A and 519A, and the hair follicle in Fig 521, B)

A still more extensive area is seen affected in Fig 520, where some fifty or sixty cells are implicated, and their greater multiplication has resulted in a more definite invasion of deeper parts   Invasion is occurring in a branched and forked manner in other parts There is chronic inflammation surrounding many of the spots where the epithelial changes

have taken place and it is noticeable that coagulated fluid is enching every point of epithelial change (*Fig* 520, A)

These remarkable appearances in the skin round the rodent ulcer suggest a multicentric origin of this disease

The tissues above described were removed by Mr Percy Legg from the chest of an elderly unmarried female who was under the care of Dr Arthur Whitfield I thank them for their permission to refer to these tissues, and they are not responsible for the observations I have made

The result of the examination of the skin surrounding the rodent ulcer of Dr Whitfield's patient induced me to examine the skin surrounding other rodent ulcers

Fig 522 is a reproduction of the epidermis taken one inch from the edge of a rodent ulcer a small group of cells can be seen at A, above the basal layer they are larger more irregular in shape, and more deeply stained than the normal cells around them They are not pigmented It is impossible to say how long they had been in that state and position

Origin of Rodent Ulcers —There is some confusion in the minds of authors as to whether rodent ulcers originate in the basal layer of epidermis hair follicles sebaceous fluids, or sweat glands The changes seen in the rodent ulcer of *Figs* 518 and 519 indicate that their genesis is in the epithelial cells in the basal layer of epidermis and in the basal layer of hair follicles

SELENIUM IN THE TREATMENT OF MALIGNANT DISEASE.

By A S GILLETT and C P G WAKELEY, London

Owing to the fact that numerous cases of the employment of selenium in the treatment of malignant disease have been reported in surgical literature by several observers during the last seven years, it was deemed advisable to investigate the matter thoroughly, and to collect a series of cases covering a wider and more complete field of observation   This was made possible during the last two and a half years by the kindness and ever-ready help of the surgical staff of King's College Hospital   We wish to make it perfectly clear that this paper is in no way intended to be an essay on selenium therapy, and therefore any reference to the writings of other observers whether at home or abroad has been intentionally excluded   We consider the bare statement of the practical results to be of more value than a bulk of bibliography, at the same time we have thoroughly investigated the reports upon cases published during the last ten years   These reports originate from many sources, and do not embrace a sufficient number of cases to prove of really practical value   Some observers have been content with reporting two cases   this cannot possibly give a basis upon which to draw any reliable conclusions   Therefore this report has been deliberately withheld until over one hundred cases had been dealt with

To demonstrate the lines upon which the investigation has been conducted, the details of *Case* 1 are given below

INOPERABLE CARCINOMATOUS ULCER OF THE TONGUE

Date	Local Reaction	Focal Reaction	General Reaction	Pain	Appetite	Weight	Dose Intra Muscular	Remarks
1919								
July 12	+	0	+ +	0	0	9 st	1 c c	Jaws can be separated to the extent of 1¹ in
13	+	0	+ +	0	0	—	1 c c	
, 14	+	0	+ +	0	0	—	2 c c	
15	+	0	+ +	0	0	—	2 c c	
16	+	0	+ +	0	0	—	2 c c	
17	+	0	+ +	0	0	—	2 c c	
18	+	0	+ +	0	0	—	2 c c	
19	+	0	+ +	0	0	8 st 6 lb	2 c c	
20	+	+	+ +	0	0	—	2 c c	Glands in neck larger
21	+	+	+ +	0	0	—	3 c c	
24	+	+	+ +	0	0	—	3 c c	
26	+	—	+ +	— +	0	—	5 c c	Ulcer bigger and more septic
29	—	+	+ +	+ +	0	—	5 c c	
Aug 6	+	+	+ +	+ +	0	—	5 c c	
11	+	0	+ +	0	0	—	5 c c	
15	+	+ + +	— + +	—	0	8 st 4 lb	5 c c	Focal reaction very marked
22	0	+ +	— —	0	0	—	5 c c	Injections stopped for a week
29	0	0	0	0	0	—	5 c c	Jaws can be separated 1 inch
Sept 12	— —	— +	+ —	0	0	8 st	5 c c	
Oct 3	— —	— —	0	0	0	—	5 c c	Very weak
10	— —	0	— —	+ —	0	—	5 c c	Glands
17	— —	— —	— —	— —	0	7 st 4 lb	5 c c	Ulcer
24	— —	— — —	— —	— —	0	—	5 c c	A secondary hæmor rhage
Dec 31	Died							

0 = no change   — = slight reaction   — — = marked reaction   — — — = very marked reaction

As will be clearly seen from the above case, one point was very early recognized to be of great importance that was the question of dosage At the twelfth injection, when 5 c c was administered, the ulcer it once became bigger and more septic, within a fortnight this focal reaction had reached such a height that injections had to be discontinued for a week they were continued again the following week when this state of affairs not only continued but became gradually worse, and the patient died in a little over a month As a result of this it was perfectly obvious that a large dose (5 c c) if continued week by week, spelt disaster and that in future a smaller dose should be given immediately after the maximum had been reached It did not take long to appreciate the fact that in the majority of cases, a lower average dose was the only method by which a focal reaction of such intensity as to necessitate cessation of treatment could be avoided

Systematic blood examinations elicited the fact that a leucocytosis was undoubtedly present after the earlier injections, but not after the later ones No other blood changes were ever found Thus no doubt explains the apparent improvement, both local and general, which is often referred to by the patient Furthermore, it also demonstrates how easy it is to report on a case with unjustifiable enthusiasm if the patient is watched for eight or ten injections only, and not kept under observation to the end

Another point the importance of which cannot be overlooked is the influence of the injections upon the general toxæmia present in these cases After the first few injections this influence is unquestionably beneficial the toxæmia being diminished—with a concurrent improvement in the general health of the patient After later injections, however, exactly the opposite state of affairs is seen, the general toxæmia becomes worse, whilst ulceration, necrosis, and secondary hemorrhage supervene In that case, why should not only two or three small doses be given, the tragedies following further doses thus being eliminated

The question of combined treatment was carefully investigated Neither the combination of selenium with x rays nor that of selenium with radium was found to be of benefit

Lack of space prohibits the publication of details of the whole series, therefore only those of the first fifty are appended As a result of experience with other colloidal compounds, it was decided that the intramuscular method should be adopted throughout the investigation this method is in our opinion the most practicable and the most satisfactory

Of the second fifty cases thirty have died, ten are in a dying condition, and ten are alive but of these ten, six are cases of atrophic scirrhous cancer of the breast In many cases the selenium treatment had to be discontinued owing to the great focal or general reaction Of the thirty fatalities, death took place in each within eight months of commencing the selenium treatment Two cases deserve particular mention, in that they show the fallacy of so-called cures, especially when a case is not followed to the end

1 A middle aged man was operated on in October, 1918, for a suspicious ulcer of the tongue, extending on to the floor of the mouth He gave a history of having noticed the ulcer for three months The growth proved to be epitheliomatous, it recurred later, and was then treated with radium and x rays In September, 1919, selenium treatment was begun an average of 2 5 c c being given every five days The ulcer slowly diminished, and by December was completely healed This seemed an apparent cure But the growth recurred in January 1920, and though selenium treatment was continued, early and extensive ulceration ensued The cervical glands were soon involved increasing in size with rapidity The patient died in Nov 1920

2 A married woman age 47, was admitted to hospital on Jan 21, 1920, suffering from ascites An operation was performed Feb 3, 1920 Both ovaries were found to be carcinomatous and were removed, there were no secondary deposits Selenium treatment was begun immediately after she left the hospital, Feb 16 No recurrence of the symptoms took place, and the general health remained satisfactory until July, 1921, when

the ascites reappeared, with signs of growth in the abdominal cavity She died early in November, 1921 The selenium treatment was continued until a short time before her death

It will be noted on perusal of the table below that several cases refused to continue with the treatment—the pain and general reactions being so severe A marked feature in a great many patients was the insomnia, this frequently being severe and persistent

In many cases the date of death and of the discontinuation of the selenium treatment did not necessarily coincide In some death took place during the treatment, while the patients were under our own observation , in others we are indebted to various practitioners for reports after the patients had passed from under our notice

A SERIES OF FIFTY CASES OF MALIGNANT

Case No	Age	Sex	Tumour		Injections					Period from onset in Mont
			Site	Nature	Method	Average Dose	No of Doses	Average Interval in Days	Total Dose	
1	73	M	Tongue	Epithelioma	Intramuscular	3 c c	22	5	82 c c	Five
2	57	M	Rectum	Carcinoma	Intramuscular	5 c c	5	5	25 c c	Three
3	57	F	Breast	Scirrhous carcinoma	Intramuscular	5 c c	12	5	60 c c	Eight
4	43	F	Breast	Scirrhous carcinoma	Intramuscular	5 c c	8	8	36 c c	Eight
5	70	M	Tongue	Epithelioma	Intramuscular	5 c c	8	7	34 c c	Three
6	61	F	Colon splenic flexure	Carcinoma	Intramuscular and Intravenous	5 c c	15	5	75 c c	Four
7	80	M	Tongue	Epithelioma	Intramuscular	5 c c	4	7	20 c c	Two
8	46	F	Cervix uteri	Carcinoma	Intramuscular	5 c c	3	5	13 c c	Two
9	50	F	Vulva	Carcinoma	Intramuscular	3 c c	3	10	9 c c	One
10	70	F	Breast	Scirrhous carcinoma	Intramuscular	5 c c	11	7	33 c c	Four
11	48	F	Breast	Scirrhous carcinoma	Intramuscular	3 c c	4	7	12 c c	Three
12	34	F	Breasts	Scirrhous carcinoma	Intramuscular	3 c c	12	5	35 c c	Five

CONCLUSIONS

1 Temporary improvement is the most that can be expected

2 To obtain temporary improvement small doses are essential, the number of injections being limited to eight or ten

3 Pain and insomnia are aggravated in most cases   On these grounds, or because of the severity of the local reaction, the injections have to be suspended

4 The weight of the patient follows the same course as in every malignant lesion We have never seen the gain in weight noticed by other observers

In conclusion, we wish to tender our sincere thanks to the surgical staff of King's College Hospital for their constant help, courtesy, and unbiased opinion

DISEASE   TREATED   BY   MEANS   OF   SELENIUM

RESULT

irst seen July 12, 1919   History of ulcer two months   Died December 31, 1919 from secondary hæmorrhage after lingual artery had been tied   Post mortem   Malignant glands on both sides of the neck   No other secondary deposits seen Marked emaciation

irst seen July 25 1919   History of diarrhœa two months   No constipation   Large ulcerated nodular growth in the posterior wall of rectum   Colostomy performed August 1 1919   Marked general reaction from injections   Died November 20 1919   Post mortem   Hard nodular rectal growth extending through the bowel wall into the perirectal tissues   Secondary glands along the aorta and several secondary deposits in the liver   A little free fluid in the abdomen

irst seen July 28 1919   History of lump in breast nine months   General reaction marked   injections discontinued after eight months owing to pain   Died August 10, 1921

irst seen August 2ⁿ, 1919   History of lump in breast nine months   After four injections growth fungated and breast was removed   Patient refused further injections as they were so painful   Died August 20, 1920

irst seen June 10 1919   History of ulcer in mouth two months   Excision of half the tongue with portion of alveolar process of jaw July 2 1919   Injections commenced but glands in the submaxillary triangle grew fairly rapidly   Patient became demented and was sent to an asylum in January 1920   Died February 2, 1920

irst seen July 20 1919   Symptoms four months   Transverse colon anastomosed to sigmoid colon July 23, 1919   Abdominal tumour continued to increase in size and secondary nodules could later be palpated in the liver   Considerable pain after injections   Died November 15, 1919

irst seen September 4, 1919   History six months   Marked focal reaction   so injections were discontinued   Died November 18, 1919

irst seen September 20, 1919   History three months   Pain was so marked after injections that they were discontinued Died November 18, 1919   Post mortem   Extensive growth into pelvis on each side almost surrounding left ureter causing hydronephrosis   Secondary glands along aorta   No other secondary deposits

irst seen September 25 1919   History three months   Local focal and general reactions very marked   Died October 27, 1919

irst seen October 20 1919   History six months   Marked focal reaction   Developed œdema of arm, ascites and secondary deposits in liver   Died after four months treatment February 28 1920   Post mortem   Scirrhous carcinoma invading right side of the chest wall and extending into the pleural cavity   Secondary deposits in the mediastinal glands and in the liver   Much free fluid in abdomen

irst seen October 15, 1919   History four months   Growth fungated through the skin after the injections   Died January 1 1920

irst seen September 10 1919   History four months   Right breast amputated September 17, 1919   Left breast amputated October 7 1919   Skin grafted on both sides   Rapid dissemination   Injections very painful   Died February 10, 1920 Post mortem   The skin over the back and sides of the chest wall was invaded by growth   Secondary deposits were found all over the abdominal cavity and viscera including the uterus

A SERIES OF FIFTY CASES OF MALIGNANT

CASE No	AGE	SEX	TUMOUR		INJECTIONS					PERIOD OF TERMINAL OBSERVATION IN MONTH
			Site	Nature	Method	Average Dose	No of Doses	Average Interval in Days	Total Dose	
13	33	F	Breast	Scirrhous carcinoma	Intramuscular	5 c c	7	10	26 c c	Four
14	73	M	Cheek	Epithelioma	Intramuscular	5 c c	10	5	44 c c	Three
15	61	M	Anus	Epithelioma	Intramuscular	4 c c	8	7	27 c c	Ten
16	44	M	Rectum	Carcinoma	Intramuscular	5 c c	9	5	48 c c	Four
17	48	M	Colon sigmoid	Carcinoma	Intramuscular	4 c c	8	7	24 c c	Four
18	76	M	Bladder	Carcinoma	Intramuscular	3 c c	4	7	12 c c	Three
19	35	M	Rectum	Carcinoma	Intramuscular	4 c c	5	7	20 c c	Two
20	72	M	Tongue	Carcinoma	Intramuscular	5 c c	5	7	22 c c	Three
21	75	M	Tongue	Carcinoma	Intramuscular	5 c c	4	7	17 c c	Two
22	60	M	Stomach	Carcinoma	Intramuscular	3 c c	4	7	14 c c	One
23	35	F	Glands	Lymphadenoma	Intramuscular	c c	6	7	16 c c	Two
24	65	M	Prostate	Carcinoma	Intramuscular	4 c c	4	7	17 c c	Three
25	67	M	Tongue	Carcinoma	Intramuscular	5 c c	7	7	35 c c	Three
26	74	M	Kidney	Hypernephroma	Intramuscular	c c	3	7	9 c c	Two
27	21	M	Neck	Lympho sarcoma	Intramuscular	3 c c	4	7	8 c c	Two
28	70	M	Palate	Teratoma	Intramuscular	2 c c	4	7	8 c c	Two
29	58	M	Stomach	Carcinoma	Intramuscular	5 c c	10	7	50 c c	Two
30	70	M	Prostate	Carcinoma	Intramuscular	2 c c	7	7	15 c c	Two
31	62	M	Retroperitoneal	Sarcoma	Intramuscular	2 c c	4	7	8 c c	One
32	56	M	Cheek	Epithelioma	Intramuscular	c c	15	5	50 c c	Four
33	52	M	Prostate	Carcinoma	Intramuscular	c c	7	7	17 c c	Two
34	54	M	Tongue	Carcinoma	Intramuscular	5 c c	7	7	15 c c	One

DISEASE TREATED BY MEANS OF SELENIUM—*continued*

RESULT

seen October 20, 1919   History nine months   Local focal and general reactions marked   Died May 3 1920

: seen November 20 1919   History three months   General reaction marked   Developed facial paralysis   Died nuary 2, 1920

: seen December 20 1919   History six months   Colostomy performed   Died October 10, 1920   Post mortem irked malignant infiltration of peirrcetal tissues and of the levatores ani muscles   Malignant glands in both inguinal gion-   Marked emaciation

t seen January 20 1920   History three months   Colostomy performed March 17 1920   Focal reaction so marked jections had to be discontinued   Died May 18, 1920   Post mortem   Malignant ulcer of rectum almost perforating ie bladder   Large secondary glands on either side of the rectum in the sacral concavity   A few malignant glands at ie bifurcation of the aorta   No secondary deposits in the liver

t seen June 3 1920   History two months   Colostomy performed August 3, 1920   Injections discontinued owing to un   Died October 29 1920   Post mortem   Large nodular carcinomatous mass in the upper portion of the sigmoid lon adherent to some coils of small intestine   Several secondary glands along the aorta

t seen August 20, 1920   History two months   Permanent suprapubic cystostomy   Injections discontinued owing pain   Died November 25 1920   Post mortem   Bladder almost entirely invaded by growth which compressed both reters, causing bilateral hydronephrosis   A few secondary glands at the sacral promontory

t seen July 25 1920   History six months   Colostomy performed July 31, 1920   Injections had to be discontinued wing to pain   Growth ulcerated into bladder   Died October 30 1920   Post mortem   Large rectal growth which had ansed a recto vesical fistula   Malignant glands in sacral concavity and along posterior abdominal wall

st seen September 27 1920   History six months   Injections were discontinued owing to pain   Died January 2, 1921

st seen September 27 1920   History four months   Injections discontinued owing to pain   Died December 28, 1920

st seen October 5 1920   Injections had no effect on the condition   Died October 31, 1920   Post mortem   Diffuse arcinomatosis of stomach   Secondary glands in lesser omentum and several secondary deposits in the liver

t seen October 7 1920   History nine months   Injections very painful   Died December 12, 1920   Post mortem Mediastinal glands much enlarged   Liver and spleen typical hard bake'   Ascites

t seen November 12 1920   Prostatic symptoms for six months   Suprapubic cystostomy performed November 15, 1920 Injections were discontinued owing to pain   Died February 10, 1921

st seen December 5 1920   History three months   Marked focal reaction   Septic bronchopneumonia developed, and Patient died March 16 1920

st seen November 22 1920   History of renal swelling one and a half years   Hæmaturia worse after injections   Died May 1921   Post mortem   Secondary glands on both sides of the aorta   Secondary deposits in liver and left lung

st seen November 2 1920   History four months   Tumour grew rapidly after injections and tracheotomy had to be performed   Died December 2 1920   Post mortem   Enormous mass on left side of neck surrounding the trachea and œsophagus   Secondary deposits in mediastinum and liver

t seen December 21 1920   History three months   Injections caused hæmorrhage from growth   Died January 30 1921

rst seen November 9 1920   History of gastritis ten months   Gastro enterostomy performed   Injections were discontinued owing to pain   Died January 20 1921

rst seen December 10 1920   Permanent suprapubic cystostomy performed March 1 1921   Died April 2 1921

rst seen March 4 1921   History of œdema of legs three months   Vomiting became so marked after injections that they had to be discontinued   Died April 2 1921

rst seen December 1 1919   History two months   Growth excised December 16 1919   Selenium given but recurrence soon evident   Died October 25 1920

rst seen November 5 1919 when calculus was removed from bladder   no sign of growth   Perineal prostatectomy performed March 8 1920   Injections had to be discontinued after two months owing to pain   Died June 6 1920

rst seen August 22 1920   History nine months   Partial neurectomy of lingual and hypoglossal nerves performed October 20 1920   Injections were discontinued owing to intense general reaction   Died November 16 1920

A SERIES OF FIFTY CASES OF MALIGNANT

Case No	Age	Sex	Tumour		Infections					Period of Personal Observation in Month
			Site	Nature	Method	Average Dose	No of Doses	Average Interval in Days	Total Dose	
35	42	F	Breast	Carcinoma	Intramuscular	3 c c	7	7	22 c c	One
36	60	M	Œsophagus	Carcinoma	Intramuscular	3 c c	9	7	25 c c	Two
37	70	M	Prostate	Carcinoma	Intramuscular	3 c c	4	7	12 c c	Two
38	50	M	Tongue	Carcinoma	Intramuscular	5 c c	25	7	115 c c	Three
39	72	M	Prostate	Carcinoma	Intramuscular	2 c c	6	7	12 c c	Three
40	25	M	Femur	Periosteal sarcoma	Intramuscular	3 c c	10	7	35 c c	Six
41	50	F	Rectum	Carcinoma	Intramuscular	2 c c	23	7	60 c c	Six
42	56	F	Sigmoid	Carcinoma	Intramuscular	4 c c	18	9	90 c c	Six
43	60	F	Breast	Atrophic scirrhous carcinoma	Intramuscular	5 c c	16	7	80 c c	Four and a half
44	19	F	Breast	Atrophic scirrhous carcinoma	Intramuscular	3 c c	8	9	24 c c	Eight
45	61	F	Rectum	Carcinoma	Intramuscular	2 c c	10	5	20 c c	Six
46	62	M	Tongue	Epithelioma	Intramuscular	2 c c	20	9	40 c c	Four
47	58	M	Tongue	Epithelioma	Intramuscular	2 c c	22	5	44 c c	Three and a half
48	60	F	Breast	Carcinoma	Intramuscular	2 c c	14	5	28 c c	Ten
49	47	F	Breast	Atrophic scirrhous carcinoma	Intramuscular	3 c c	16	5	48 c c	Six
50	49	M	Rectum	Carcinoma	Intramuscular	2 c c	16	5	32 c c	Five

"E TREATED BY MEANS OF SELENIUM—*continued*

RESULT

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een January 5, 1921   History six months   Injections caused no reaction at all   Died March 10, 1921

een February 3, 1921   History five months   Gastrostomy performed March 3 1921   Died April 16 1921   Post u Secondary glands in posterior mediastinum   No other secondary deposits

een March 6 1921   History six months   Focal reaction after injections so marked that they had to be discontinued May 21, 1921

een March 19 1921   History three months   No change produced in size of tumour   Died June 25, 1921

een April 1, 1921   History one year   Focal reaction very marked   Died July 6 1921   Post mortem   Base of der invaded by growth   Secondary glands at bifurcation of aorta

een December 20 1920   History of swelling two months   Died from secondary growths in mediastinum August 11   Injections were discontinued owing to pain   Post mortem   Secondary growths in both lungs, mediastinal glands, aortic glands

een April 4, 1921   History six months   Injections discontinued owing to pain   Died October 14, 1921

een May 3, 1921   History three months   Colostomy performed May 6, 1921   Died November 10 1921

een April 2, 1921   History one year   The tumour ulcerated through the skin after the sixteenth injection and h took place rapidly   Died September 2 1921

seen March 4, 1921   History nine months   Injections discontinued owing to pain   Still alive   tumour has not red in size

seen March 7 1921   History three months   Colostomy performed   marked general reaction   Died September 10, 1

seen April 4, 1921   History three months   Died from secondary hæmorrhage August 14, 1921

seen May 7, 1921   History six months   Injections discontinued owing to pain   Died September 10 1921

seen May 6, 1921   History four months   Treatment discontinued owing to pain   Died September 16 1921

seen February 10, 1921   History two years   Condition *in statu quo*   Still under observation

seen April 2 1921   History three months   Colostomy performed   Injections discontinued owing to pain   Died tember 12 1921

SOME OBSERVATIONS ON BONE-GRAFTING. WITH SPECIAL REFERENCE TO BRIDGE-GRAFTS

By C. MAX PAGE AND G. PERKINS, LONDON

THE value of bone-grafting has become firmly established both in the treatment of ununited fractures and in the replacement of bone destroyed by disease or injury. A great deal of experimental work has been done with a view to elucidating the changes undergone by various forms of bone implant in man as well as in animals. Pioneer investigations of this character were conducted by Ollier,[1] Axhausen,[2] Macewen,[3] and others. More recently Hey Groves,[4] Gallie,[5] and Leriche,[6] have contributed valuable data

In reviewing the conclusions drawn by these and other workers, it must be admitted that some parts of the life-history of bone-grafts in adult man remain obscure, or at any rate matter in dispute. Moreover, there is considerable divergence of opinion as to the technique best adapted to secure a successful result in cases of bone implantation

The large number of severe injuries to the bones which were caused during the late war have provided an intensive practical experience of the subject, and it would seem that it should now be possible to settle finally the matter at issue. It is with the intention of contributing to this solution that we venture to put forward some observations we have made in the course of treating a series of forty-five consecutive cases operated on for ununited fracture

Recognizing that the number of our cases forms too narrow a basis to justify dogmatism, we propose in this paper to confine our attention to one section of the subject —namely *bridge-grafts*

A bridge graft may be defined as a bone-implant which fills in a definite gap in the

RESULTS IN 25 CASES OF BRIDGE GRAFTING

BONE INVOLVED	No. of Grafts	No. of Successes	No. of Partial Successes	No. of Failures	CAUSES TO WHICH FAILURE WAS ATTRIBUTED
Humerus	5	4	—	1	Failure — 1 Beef peg used as bridge graft
Radius	8	8	—	—	
Ulna	6	1	2		Failures — 1 Cause unknown. Notes of case incomplete 2 Beef peg used as bridge graft 3 Sepsis and insecure fixation of graft to host Partial Successes — 4 Insecure fixation resulting in absorption of upper end of graft and apparent fracture. A pseudarthrosis followed but the functional result was excellent 5 Mal-union upper end graft to host caused by failure to secure correct alinement before grafting. Graft came adrift and pseudarthrosis followed with excellent functional result
Tibia	6	—		2	Failures — 1 Insecure fixation resulting in non-union of graft to host. Graft ab-orbed 2 Ditto
Totals	25	16	2	6	

original bone and ultimately reconstitutes a part of it As an arbitrary standard we have included in this category only those examples in which a gap of 2 cm or more has been bridged The subjects we have treated have in all cases been adult males, so that the question of new bone-formation from the periosteum as seen in children does not affect the issue In all the cases quoted, the operation we have carried out has not been the primary one aiming at bone replacement The period elapsing between the original injury has varied from two to five years In all the cases the men have been kept under observation from the time of operation up to the present date or have been restored to industrial efficiency Radiograms of all cases have been taken at frequent intervals and filed

The conclusions we have formed in regard to the essential points in the technique of bridge-grafting are most clearly shown by the consideration of our failures Particular prominence will therefore be given to the notes of these cases

In the 45 cases of ununited fracture treated by some form of bone-implant, 31 come under the classification of bridge grafts as defined above, the gap in the bone filled being 2 cm or more The above table gives the results in 25 of these cases , the remaining 6 promise to be successful but have not been under observation sufficiently long to warrant their inclusion

I LIFE-HISTORY OF BONE-GRAFTS

Brief reference must be made to the most recent theories which have been put forward to explain the fate of bone grafts when in process of conversion into normal bone Gallie s views are that when graft and host are held firmly in apposition capillaries grow in from the host, and that blood circulation is estab lished throughout the graft The bone-cells on the surface of the graft may live and proliferate, those in the Haversian canals die and disappear in two or three weeks

Absorption of bone commences at once from the periphery and subsequently involves the whole sub-stance of the graft , meanwhile osteoblasts from the host pass *via* the re-established circulation into the graft, and lay down new bone Leriche and Policard agree with this view, and consider that the graft acts in the nature of a scaffold They maintain that the graft always dies , and that, although on exploration the bone of the graft may prove well vascularized and continuous with the host-bone, and that the grafted bone may increase in size and unite after a fracture— these are appearances of life only then histological examination demonstrates that the bone cells are all dead

FIG 523 —Graft in the presence of sepsis Seven months after graft operation Graft successful (S) Sequestra

Despite the evidence adduced by these authorities we are not convinced that the graft plays such a humble role We believe that at least some portion of it lives, and becomes incorporated with the host-bone One salient case may be quoted in support of this view —

Case 14—Ununited fracture of the radius middle third, four and a half inches of bone missing

He had been previously grafted in February, 1920, and the graft was extruded entire as a sequestrum following suppuration   We operated again in January, 1921, after the wound had been soundly healed for six months   At the operation active granulation tissue was found between the fragments   Free suppuration followed within a few days of operation   The temperature fell to normal about the tenth day and at the end of the third week the discharge from the wound was negligible   An x ray picture taken one month after the operation showed the graft in position and firmly united to the host bone at both ends , there was evidence of new bone formation, and two sequestra were separating from the graft   The wound healed soundly and the graft consolidated   *Fig* 23 was taken seven months after the operation

This case shows that an autogenous graft is capable, within a month of implantation of casting off from itself a superficial portion which has been killed as a result of acute
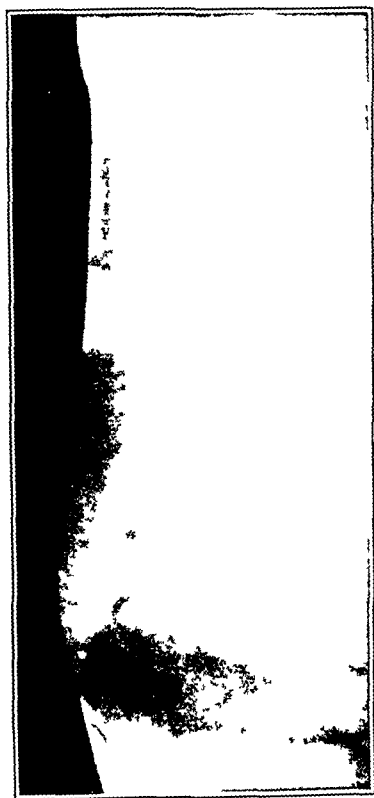
FIG 24 —Tube of beef bone as bridge-graft
One week after graft operation
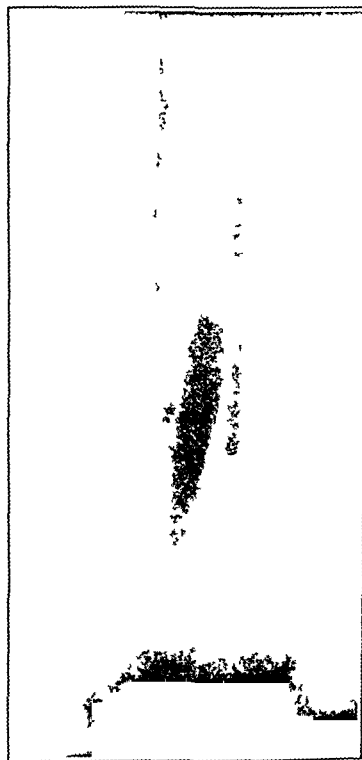
FIG 25 —The same case as *Fig* 24
four months after graft operation   The frag-
ments have been supported by splints   Callus
thrown out from the ends of host
but no new bone creeping along the graft
Inert graft lying in a cavity

inflammation   Such activity appears to us to be clear evidence of vitality   It may, of course, be maintained that the viable elements of the graft had been derived from the host , but if that is the case, as Gallie and Leriche declare, the process of taking over must be a remarkably rapid one

If one assumes that a bone-graft dies after implantation and only acts as a scaffold it is difficult to see why heterogenous or sterilized grafts should not be of the same value as autogenous   There is much evidence in the literature of the subject to show that this is not the case

We have records of two cases in which boiled beef-bone was used as a bridge graft in neither case did the graft take on the appearance and activity of normal bone

Case 5—Ununited fracture of humerus, lower third

In May, 1917, the fracture was plated, in June, 1918, the plate was removed, union being absent In November the fracture was wired without success In June, 1920, we pegged a section of beef-bone into the medulla of each fragment (*Fig 524*) An x-ray picture four months later (*Fig 525*) shows the gap closed in as a result of the fragments being approximated by splintage, and callus thrown out from the ends of the two fragments, but the graft has the appearance of a sequestrum, there is no new bone extending along the graft in the way that can be seen in any successful autogenous graft A plate taken sixteen months after operation still shows non-union We have since operated again on this case The graft was found to be quite loose, lying in a cavity which was lined by a smooth-walled layer of fibrous tissue 1 mm thick

Case 10—Autogenous graft of radius, for comparison with *Cases 5* and *19* A plate taken six months after operation clearly shows new bone being laid down in continuity with the graft (*Fig 526*)
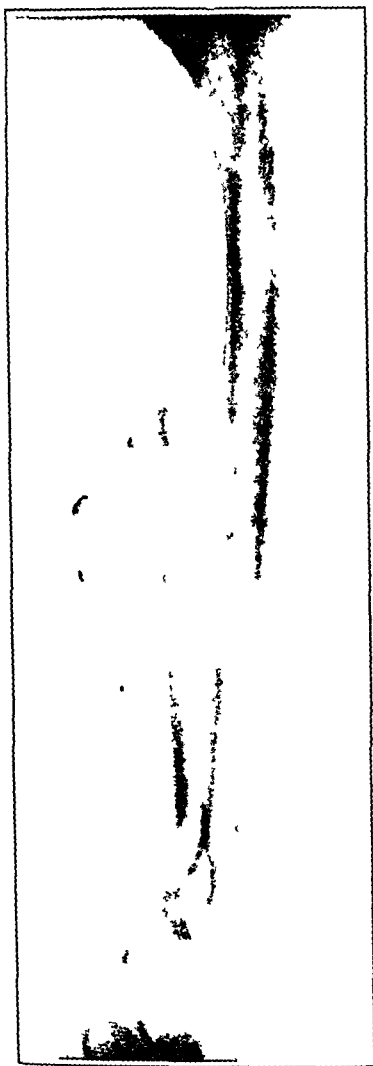
FIG 526 —Human bone graft for comparison with *Figs 524 525* six weeks after graft operation New bone creeping along graft Note the continuity of graft and host where implanted
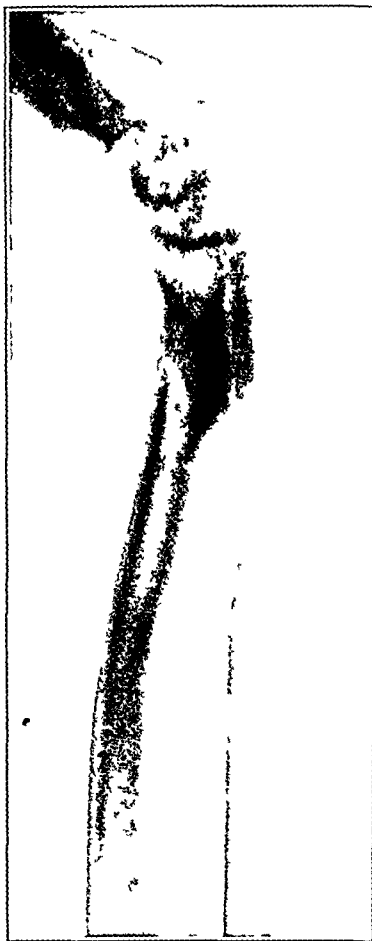
FIG 527 —Failure of beef bone as a bridge-graft Six months after graft operation Condition of graft unchanged

Case 19—Ununited fracture of the ulna, upper third gap two inches

The gap was bridged in April, 1921, by means of a beef-peg driven through the olecranon across the gap, and into the medullary cavity of the lower fragment Fixation was very firm at the time of the operation A plate taken two months afterwards shows the graft apparently inert, there is no creeping of new bone along the graft *Fig 527*, taken six months after operation shows little change in the condition except that a space has formed around the peg in the

upper fragment The peg was removed by operation in November, 1921, it was lying loose in the upper fragment surrounded by granulation tissue It was so firmly adherent in the medullary canal of the lower fragment that the latter had to be split before the peg could be dislodged There was no granulation tissue about the lower part of the graft, and the graft itself was slightly eroded in its upper part only

These two cases confirm the general evidence that a compact beef-bone peg is useless as a bridge graft It is possible that if the beef-peg contained a good proportion of cancellous bone it might be more effectively vitalized, but we have no evidence available on this point as yet Therefore, we now always employ autogenous grafts for bridging gaps, and only utilize beef-bone when its function is merely that of an internal splint

II CHOICE OF BONE CHARACTER AND SIZE OF GRAFT

1 **Selection of Bone of Origin** —In our experience the tibia provides the most satisfactory graft The bone is easy of access, and considerable latitude in the size and shape of the graft is possible, the gap in the bone from which the graft has been cut is rapidly made good, so that no permanent disability results If a curved graft is required a rib may be used quite satisfactorily We have used this type of graft with success in the case of the lower jaw The use of the fibula is favoured by some surgeons It has the merit of yielding a strong graft with an established medullary canal Against the use of this bone one may raise the points that its exposure and separation is not simple and that its absence cannot fail to unsettle the stability of the ankle-joint We have not used a graft of this character in the series under consideration
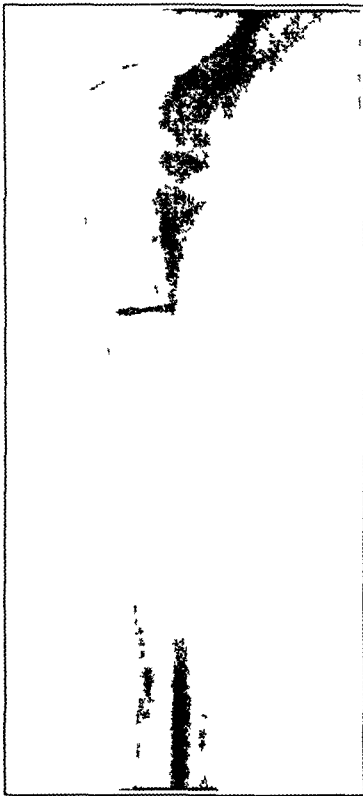
2 **Character of the Graft** —The constituents of a graft may be compact bone periosteum, and cancellous bone The compact bone is essential for strength, though it does not appear to take an active part in the formation of new bone after implantation In regard to the periosteum, we have come to the conclusion that it has little importance in the re-formation of bone in the adult From any evidence we have not been able to make out that its presence or its absence affects the fate of the implant It has been our practice in all cases to remove the periosteum from that part of the graft which is fitted into the medullary cavity of the host bone, and in our later cases we have used grafts free of periosteum turning back the periosteum from the tibia before cutting the graft

The cancellous bone seems to be the route along which new bone formation extends from the host-bone into the shaft It is therefore important to incorporate a good bulk of bone of this character in any graft (*Fig* 526)

FIG 525 —Graft too frail and consequent fracture Graft has taken Firm union both end Fracture in the middle Wire remaining from previous operation

3 **Size of Graft** —The graft should be two or three inches longer than the gap which it is designed to bridge, and so cut that it is as strong as possible consistent with its being fitted into the host-bone A long graft gives firm fixation and establishes a larger surface of contact between the host and the graft across which circulation is re-established The more substantial the graft, the less liable it is to fracture and the more rapid the re-establishment of full strength in the affected part *Case* 12 *Fig* 528 shows the futility of a weak graft

III PREPARATION OF THE HOST-BONE

1 Preliminary Excision of Overlying Scar—This procedure is advocated for many cases of war injury We have however, carried it out in two cases only

2 Position of the Fragments—It is important that the fragments should be able to be brought into their normal alinement at the time the bone is implanted

Preparatory splinting may occasionally have value in this respect A method of reducing pronation deformity in the forearm is shown in *Fig* 529 In our experience however, reposition can generally be effected only by operative means This statement is certainly true of a large proportion of war injuries on account of the gross scarring which occurs about the seat of fracture
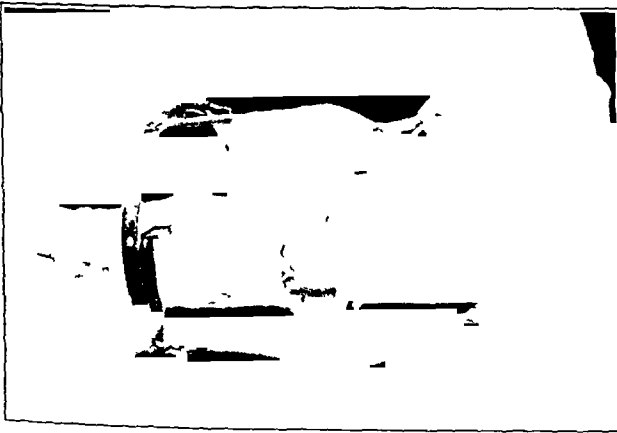
Fig 529 —Plaster splint to obtain supination

Case 12 is an example of a failure which may be attributed to the neglect of proper mobilization of the fragments *Fig* 530, taken ten months after a second operation for grafting, shows displacement of the upper fragment, and that the adjacent end of the graft is no longer in contact with the host-bone

3 Removal of Sclerosed Bone—We consider it of fundamental importance to resect both ends of the host fragments until healthy vascular bone is exposed

IV INTERNAL FIXATION OF THE GRAFT

This appears to be the most essential factor in effecting a successful bridge-graft

Unless the graft becomes firmly united with the host at both ends success is unlikely The presence or absence of this union can be detected very early after operation by means of radiograms *Figs* 531 and 532 from different cases may be compared in illustration of this point both plates were taken ten days after the
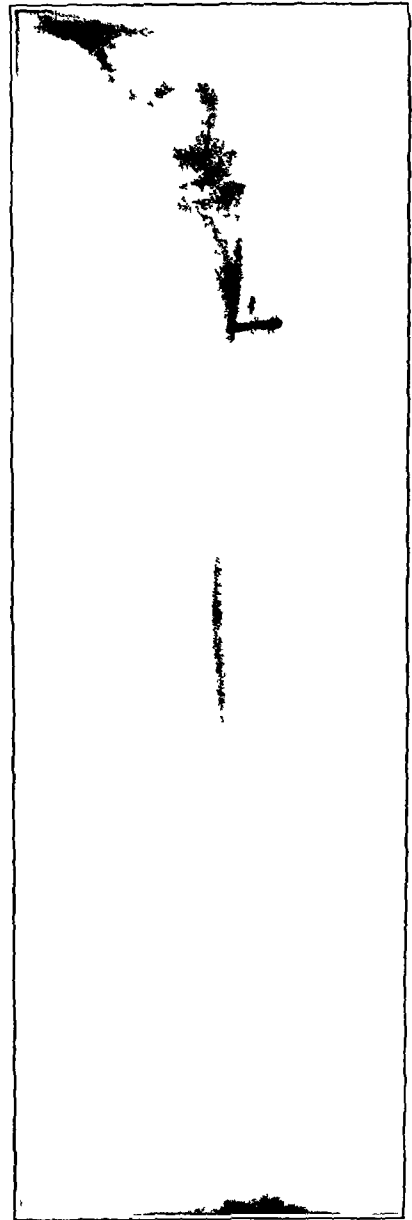
Fig 530 —Host fragments not brought into correct alinement Adduction of upper fragment not well shown Ten months after graft operation Graft separated from host above Pseudarthrosis resulted Surgically a failure From a functional point of view the arm is excellent

graft had been inserted Fig 531 shows a stout graft in good position, but a space is shown intervening between the graft and the host-bone The graft failed, and the upper end became absorbed Fig 532 shows a similar graft but there is union between the graft and host at both ends, with no space showing between the graft and host in the x ray This graft was successful

The method of fixation matters little, providing
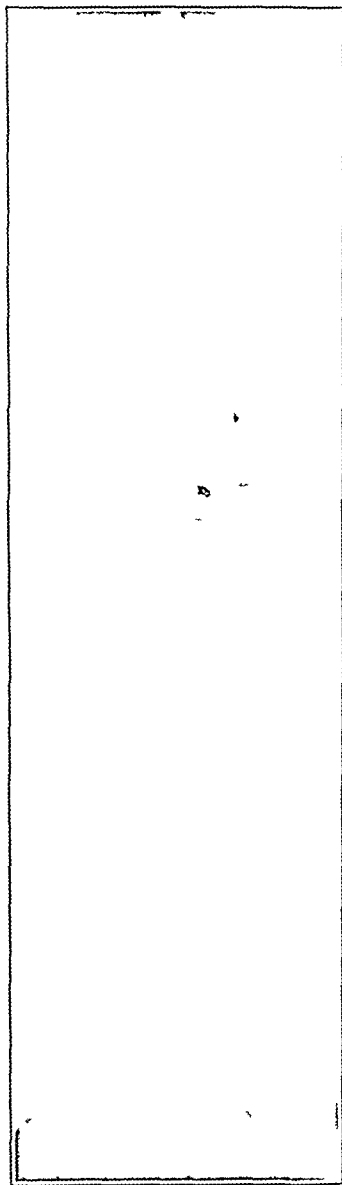
FIG 531 — Infirm fixation of graft to host and consequent failure of graft Ten days after operation Stout graft Position good but space exists between graft and host The graft was absorbed, and failed

FIG 532 — Firm fixation of graft to host and consequent success of graft Compare Fig 531 Ten days after graft operation Stout graft Position good No space visible between graft and host Firm union has taken place Graft successful Graft fixed with pegs (P)

FIG 533 — Method of fixation of bridge graft (A) The graft pegged into the medullary cavity of one fragment for an inch or more The other fragment is prepared by cutting a slot slightly less wide than the graft A saw cut is made through the compact bone for a short distance beyond the end of the slot to enable the latter to open sufficiently to receive the graft (B) The graft forced into the slotted fragment in which it should be firmly held by the elastic recoil of the bone

FIG

FIG
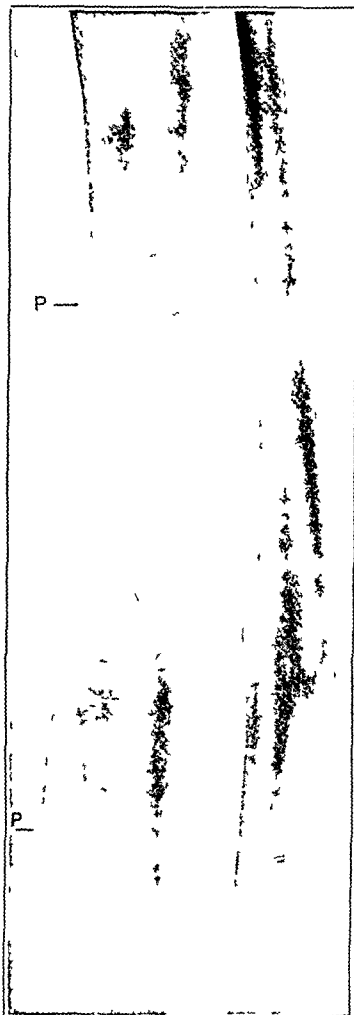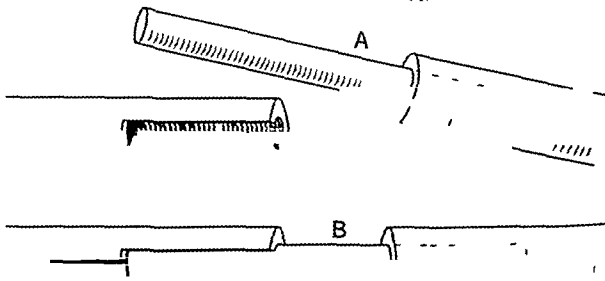
that it is firm For most cases we have found that the mechanically soundest method of effecting fixation is to peg one end of the graft into the medulla, and to fit the other into the medulla by what may be termed an inlay splice (Fig 533) One end of the

graft is driven firmly into the medullary cavity of the most mobile fragment   In the other fragment a slot is cut, about 1 mm narrower than the graft, out of the compact bone   The slot is cleared by means of a small gouge   A saw-cut about 2 cm in length is made in the compact bone at the extremity of the slot   To introduce the graft, the slot is opened slightly by forcing a chisel into it, and the graft is then crushed home into its bed with bone forceps   In some cases tapping with a hammer is used to assist the process

We sometimes employ catgut kangaroo tendon, or even wire ligatures to bind the spliced part of the graft in place , but their use should be superfluous   Our experience inclines us to the belief that if the host and graft do not remain in apposition without being
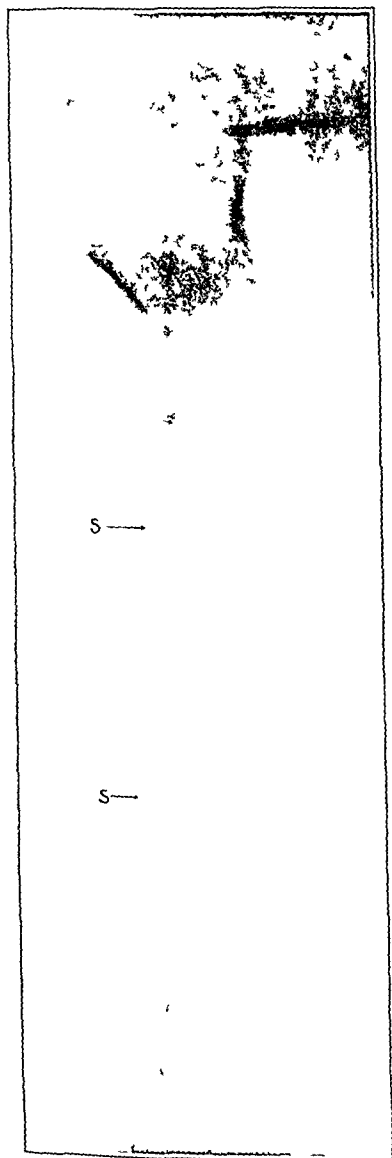
FIG 531 —Graft in the presence of sepsis   Seven months after graft operation   Lower portion has taken in spite of sepsis   One large sequestrum is separating from the graft above, and another from the host and graft below   The upper end subsequently came adrift   The lower end remained firm

(S) Sequestra
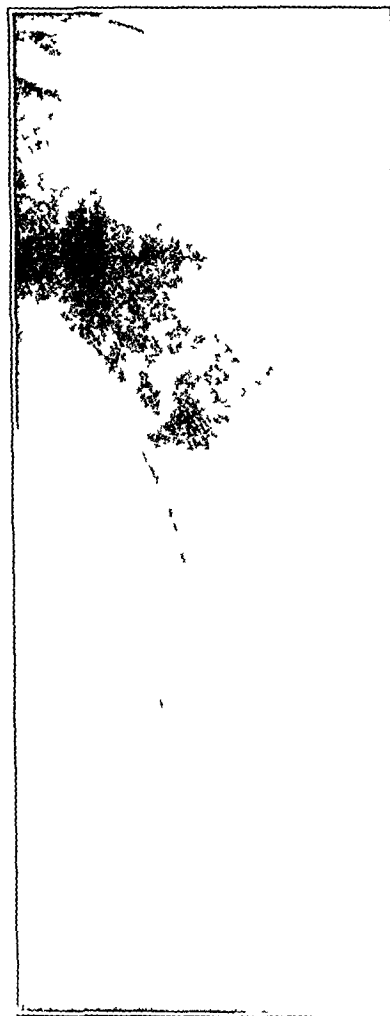
FIG 535 —Same case as Fig 534   Shows final result   Humerus short but arm function excellent   The lower end has been pegged into the upper after removal of sequestra

FIG 534

FIG 535

held by sutures, their subsequent union is doubtful and the graft likely to be a failure   Foreign material introduced to effect fixation, such as wires, pegs, bolts, and plates we hold to be undesirable—necessary at times, but always to be avoided if possible   If suppuration occurs, the graft survives intact long enough, and the skin wound heals soundly , but if foreign materials are present, sinuses down to them will inevitably form and will persist till the dead material is removed

V   BEHAVIOUR OF GRAFTS IN THE PRESENCE OF INFECTION

As a general principle it is accepted that the graft should be aseptic and that it should be implanted into an aseptic field , but infection and a successful graft are not incompatible, provided that the graft is firmly embedded in the host-bone at both ends   *Case* 14 (*see* p 542) illustrates this ability of a graft to thrive despite severe infection of the surrounding tissues   *Fig* 523 shows the condition present seven months after operation

In *Case* 24, an ununited fracture of the humerus (*Fig* 534) acute infection set in after the implantation of a graft   The graft came adrift at the upper extremity, but below it united firmly with the host   Sequestra formed both from part of the graft and from the host, and were removed   A few months after the wound had finally healed, the upper free end of the graft was pegged into the medulla of the upper fragment of the humerus   the final result giving a sound though shortened bone (*Fig* 535)

VI   GRAFT FRACTURES

Excluding the early cases due to fragility of the original graft, as in *Fig* 528, graft fractures may be recognized as falling into two distinct varieties   The two types occur at different periods after implantation in different situations in relation to the graft as a whole, and as a result of different causes

1   **The Early Fractures** — These often take place within eight weeks of the operation while the limb is still firmly immobilized and little or no strain is passing through the bone   This fracture occurs at one site only   namely   at the junction of the host and graft   It follows non-union of one end of the graft with the host-bone   and is due to the process of osteoclasis proceeding without its being followed by any new bone formation   In fact the graft is subject to the same changes which have been observed to occur when it is implanted into soft tissues   These cases though often classified as fractures are there-

FIG 536 —Non union of graft to host and consequent apparent fracture   One month after graft operation   Union union below   No union above with clear space between host bone and graft
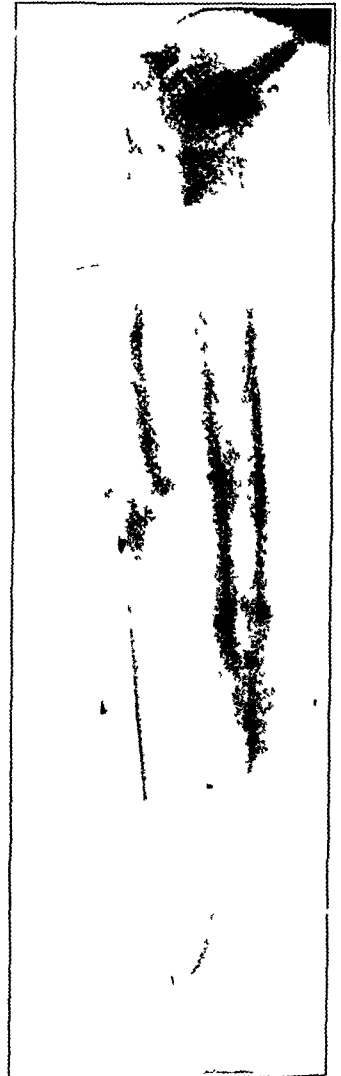
FIG 537 —Same case as Fig 536 five months after graft operation   Apparent fracture at the junction of graft and host above   and absorption of loose upper end of graft

fore really examples of bone absorption secondary to inadequate fixation of the graft Case 4 illustrates this point Fig 536 was taken within a month of the operation, it is evident that the graft is firmly united below, but loose above The upper part of the graft became slowly absorbed, and Fig 537, taken five months after the operation gives the appearance of a fracture at this level

2 **Late Fractures**—These may occur at any time up to two years from the date of operation The graft has been successful, it is firmly united at both ends and is increasing in size, the limb has been released from complete immobilization and is exposed to some strain The fracture is caused in the same way as a fracture of the normal bone—namely, because the new section of bone is called upon to bear a strain greater than its strength will stand The site of fracture is variable, but is usually about the middle of the graft

Case 3 is a good example After a gap in the tibia had been successfully bridged, the patient was walking
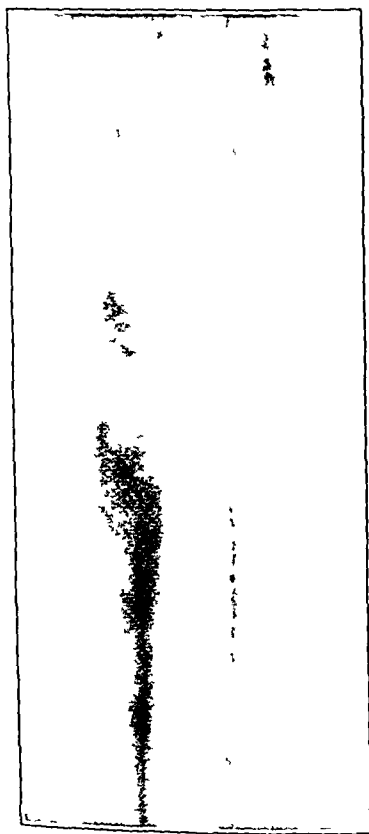
FIG 538 —Fracture of graft due to inadequate support Ten months after the fracture Fracture is obvious
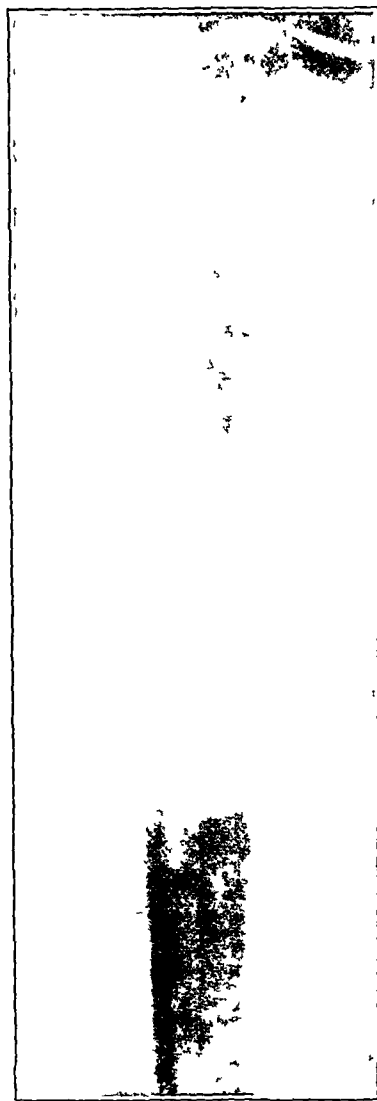
FIG 539 —Fracture of graft due to inadequate support Seven months after successful graft operation Graft was fractured one month previously and is now uniting Callus visible around seat of fracture which is almost at the upper junction of host and graft

FIG 538

FIG 539

in a plaster splint which fitted too loosely, and six months after the operation sustained the fracture Fig 532, taken ten days after operation, shows firm union between the host and graft A radiogram taken shortly after the fracture shows this as a fissure In radiograms taken at monthly intervals the line of fracture becomes more apparent Fig 538 was taken ten months after the fracture had occurred

The early fractures are due to faulty technique in respect of the fixation of graft to host, the late fractures are traumatic, and do not denote any shortcoming on the part

of the primary operative technique, but are due either to insufficient support of the injured bone, or rashness on the part of the patient   The prognosis of the two varieties differs In the early fractures the graft has definitely failed to take on its intended function, and union cannot be expected   In the case of the traumatic fractures union does occur, at any rate in some cases   *Case* 15 had a bridge-graft of the tibia which broke eight months after operation, both ends being firmly consolidated   *Fig* 539 shows the presence of a fracture in the graft which occurred a month previously, and which shows signs of uniting In our experience the process of union in fractures of this kind is a slow one, and we incline rather to implant a new graft in order to save time   This was done in *Case* 3

VII   POST-OPERATIVE TREATMENT

This may be divided into three clinical stages as follows —

1 **Stage of Absolute Rest** —This comprises the first six weeks following operation The joints above and below the graft are firmly immobilized in a plaster-of-Paris casing applied on the operation table   During this period the graft is establishing a vascular continuity with the host at either end and with the surrounding tissues   unless this process is completed a graft will fail

2 **Stage of Partial Function** —After the expiration of about six weeks, light use of the limb is permitted a splint being applied so as to support the bone while allowing movement at the adjacent joints   In the case of fractures of the tibia a closely fitting plaster is applied, moulded above around the bony points below the level of the knee joint and below to the malleoli (*Fig* 540)   This apparatus will allow free movement at the knee and ankle, but gives considerable vertical support to the bone   In the forearm a plaster casing is applied with the arm in the extended position   it reaches from the middle of the arm above to the level of the wrist below

3 **Stage of Full Function** —When the graft has consolidated, and is estimated by means of radiograms to have the strength about equal to half that of the normal bone, all splints are removed, and the nutrition of the limb is restored by massage tardism, and active use   The change from the stage of partial function to that of full function depends on the individual bone involved   For example, full freedom can be allowed in the case of fractures of the radius much earlier than in the case of the tibia   No definite rule can be laid down for all cases and some conservatism will certainly avoid the incidence of disappointing fractures

Fig 540 —Plaster walking splint Thin stocking only under the plaster Plaster closely moulded to the leg Free range of movement allowed at knee and ankle

VIII   OTHER FACTORS INFLUENCING THE SUCCESS OF BRIDGE-GRAFTS

1 **Bone Involved** —It is generally accepted that the probabilities of successful grafting vary in the different bones

The humerus we have not found to offer any special difficulties, provided satisfactory splint fixation is effected   It is seldom that a wide gap has to be bridged in this bone, as considerable shortening is consistent with good function

In our experience in common with that of others, the radius can be grafted with the greatest ease   We have had no failures in ten consecutive cases

The ulna is undoubtedly less satisfactory   It is difficult to imagine that the vascular supply of this bone is so different from others as to be the cause of the difficulty   Two factors suggest themselves —

a That at the time of the operation the fragments are not sufficiently mobilized to make it possible to aline them without splints   the upper fragment is nearly always flexed and deviated to the radial side

b That the common position of immobilization after grafts of this bone is incorrect We have generally fixed the limb after operation at an angle of about 110° in these cases   The fact that in simple fractures of the forearm the fragments are most correctly alined in full extension suggests that this position may be the proper one for fixation after graft operations on this bone

In our experience there is no objection to grafting both bones of the forearm at the same operation   *Case* 16 is an instance of this procedure, undertaken secondary to an operation for shortening both bones which had failed to produce union   *Fig* 541 shows the two grafts in position two months after our operation   *Fig* 542 shows the condition seven months after operation

In the tibia, grafts in the lower third have a doubtful prognosis   This is possibly due to the difficulty in immobilizing the lower fragment   Grafts in the upper and middle thirds give good results

2 Latent Infection of the Host-bone —In our early cases we were inclined to attribute some of our failures to the presence of infection   But with an improved technique and a more extensive experience of the subject we think that it is seldom, if ever a causative factor   It would appear, in reviewing our unsuccessful cases, that inadequate fixation of one end of the graft is the common factor responsible for failure

FIG 541 —Graft of radius and ulna at the same operation   Two months after graft operation
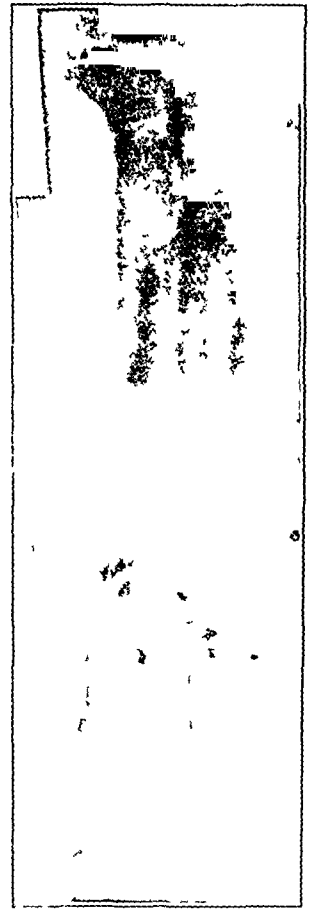
FIG 542 —Same case as Fig 541   seven months after operation   Graft successful

SUMMARY AND CONCLUSIONS

The subject matter of this paper relates only to bridge-grafts in the adult

1 From the evidence of radiograms it would appear that bone implants possess and retain a vital activity for some period independent of the tissues of the host

2 Boiled beef-bone cannot be used successfully as a bridge-graft , it is however valuable if employed as an internal splint

3 For successful bridge-grafting the graft should be autogenous   The most satisfactory source for most purposes is the tibia   The graft should contain sufficient compact bone for strength, and as much cancellous bone as possible   It is in relation to the cancellous part of the graft that firm union with the host-bone takes place, and that new bone is laid down to thicken the implant in the first few months after implantation   The presence

or absence of periosteum on the graft does not appear to affect its vitality or its later enlargement in response to function

4 Two steps are necessary in the preparation of the host fragments   (a) Removal of the sclerosed ends till healthy vascular bone is exposed , (b) Mobilization of the fragments so that they can be normally alined without tension

5 The most important factor governing success is the firm fixation of the graft into both extremities of the host-bone

6 The method of fixation of the graft found most satisfactory for the average case is by intramedullary pegging at one end and by an inlay splice at the other

7 Fractures of the graft fall into two categories   (a) Apparent fracture at the junction of the host and graft , these fractures occur at an early stage, and are due to the weakening of the implanted part of the graft by absorption which results when it is not in firm contact with a healthy section of host-bone   (b) Fractures in the free part of the graft   these occur from inadequate support of the limb after the implanted ends of the graft have become firmly incorporated with the host-bone

8 Post operative treatment may be divided into three clinical stages   (a) During the first six weeks absolute immobilization of the part involved , during this stage the graft unites firmly with the host-bone   A radiogram taken at this period will show whether or not the graft is successful , if implantation of the graft has been so carried out that vital continuity between it and the host-bone becomes established, no space is seen between the graft and the host-bone in the picture , if fixation has not been firm, a clear area is seen between the graft and the host-bone, and the related part of the graft will become gradually absorbed, and finally give the appearance of being fractured where it is in contact with the host bone   (b) After six weeks, partial function of the limb involved is allowed, adequate splint support being supplied to prevent fracture from undue strain   (c) When the graft in response to function has sufficiently thickened, all support is removed, and the return of full nutrition and activity in the limb is assisted by physio therapy

9 The ease with which successful bridge-grafts can be carried out varies in different bones   The radius gives the largest proportion of successes   The upper third of the ulna and the lower third of the tibia have been found to be the most difficult

10 We have attributed most of our failures to unsatisfactory fixation of one end of the graft to the host-bone

11 Post-operative infection of the wound is not incompatible with the survival and growth of a bridge-graft

We wish, in conclusion, to acknowledge our debt to Drs R J Reynolds and W P Tindal-Atkinson for their invaluable help in taking the radiograms upon which this study has been based   We are also much indebted to Mr G W Heckles for the careful records which he kept of the earlier cases of the series referred to in the text

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EXCISION OF THE OS CALCIS FOR TUBERCULOUS OSTEITIS: A LATE END-RESULT.

By C P G WAKELEY, London

This case is recorded with the view of showing how little deformity and disability occurs after excision of the os calcis The operation was performed twenty-one years ago on a patient with a very bad tuberculous history The following is a report of the case —

Miss E B , age 20, was admitted to King s College Hospital in 1900, under Mr Burghard, with two tuberculous sinuses in her left heel leading down to the os calcis One of her brothers suffered from tuberculous abscesses in the neck for several years previous to her admission to hospital Her left ankle first became swollen at the age of ten , later, an abscess formed and an operation was performed at University College Hospital, and after this the ankle was operated upon five times The foot remained

Fig 2 —Lateral view of the foot from which the os calcis was removed in 1900

Fig 1 —Skin scars (antero posterior view)

healed for two years from 1894 to 1896 when a swelling appeared at the outside of the foot and, later, a sinus formed on the inner side of the ankle Rest and immobilization fa ed to relieve the condition and an operation was decided upon by Mr Burghard An incision was made along the outer border of the foot backwards from the 5th metatarsal, and continued round the back of the heel to a point below the inner malleolus The deep fascia was divided and the soft tissues were dissected off the surface of the os calcis The peronei and other tendons were drawn out of position The various interosseous ligaments having been divided, the os calcis was finally detached from its surroundings and removed The flaps were drawn together and sewn up with silk stitches The wound healed soundly On cutting open the excised os calcis a tuberculous deposit was found extending from its centre to the inner edge of the bone and opening at the site of the sinus The patient was not seen again until October 1921 She had married, and continued to enjoy very good health She could walk considerable distances—

several miles—without pain or fatigue   There was not the least sign of a limp   There appeared to be about half an inch of shortening of the left leg , the reason for so little shortening appeared to be due to an excessive deposit of fat and fibrous tissue in the region of the heel   The lateral view of the foot (*Fig* 543) demonstrates this well   The two skiagrams (*Figs* 544, 545) taken in two directions show the complete absence of the os calcis , some of the other tarsal bones give evidence of old standing chronic osteitis

Fig 543 —Skiagram (lateral view)

It is well known that very excellent functional results are obtained after removal of the os calcis in childhood   This case is interesting as showing that perfect function may follow without any alteration in the remaining bones of the tarsus   Two other cases may be mentioned, both operated upon by Mr Burghard, in which the functional result was equally good   One was that of a girl, age 24, with a condition of the os calcis very similar to that described above   The removal of the os calcis by the same incision was done ten years ago, and the patient walks perfectly with a cork wedge in the heel of the boot   The other case was in a man, age 32, for a shrapnel wound of the bone, which was extensively crushed   The operation was done in 1916, and the result is excellent

RECURRENT ANTERIOR DISLOCATION OF THE LOWER END OF THE ULNA COMPLICATED BY UNUNITED FRACTURE OF THE STYLOID PROCESS OF THE ULNA.

By A PHILP MITCHELL, Edinburgh

The infrequent occurrence of cases of recurrent luxation of the lower end of the ulna justifies the publication of the following case, which was demonstrated at a special meeting of the British Orthopædic Association in Edinburgh, in June, 1920

J McK, age 23, was admitted to the Edinburgh War Hospital Bangour, on Nov 10, 1919, with the complaint that movements of the forearm were painful, and were frequently followed by dislocation at the wrist

On Examination —The condition shown in the photograph (*Fig* 546) was obvious The patient could, with ease, produce the dislocation by extreme supination and as easily accomplish its reduction On pronation the ulnar head slipped back into place, but it could readily be pushed backward and forward Lateral separation from the radius was not possible The wrist was narrower than normal, and its anteroposterior diameter was only slightly increased The outline of the wrist as seen from the back was curious The normal dorsal prominence of the ulnar head had disappeared, leaving a depression which began above in a gradual slope, was bounded laterally by the sharp edge of the radius, and inferiorly by the somewhat abrupt edge of the now prominent cuneiform The ulnar head was dislocated forward and slightly inward, and was palpable under the flexor tendons The interference with the function of the forearm was sufficiently marked to be a source of annoyance, and there was also evidence of a secondary ulnar neuritis Radiograms taken twenty-one months after the original injury showed that the dislocation was complicated by an ununited fracture of the styloid process of the ulna The radius was intact (*Fig* 547)
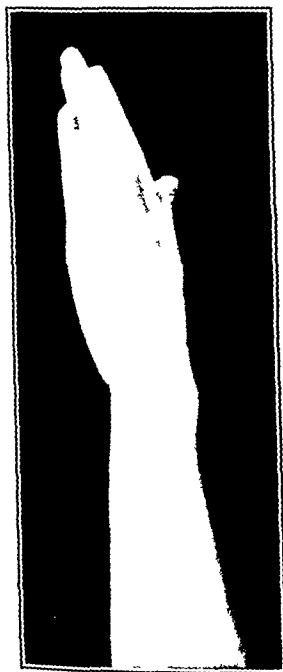
FIG 546 —Wrist before operation Note narrowness of the wrist and sharp edge of the radius bounding laterally the depression left by the ulnar head
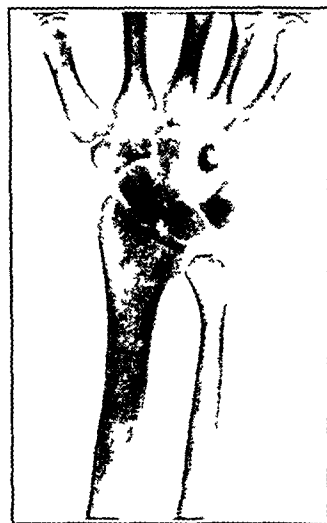
FIG 547 — Recurrent anterior dislocation of the ulna complicated by ununited fracture of the styloid process of ulna Radius intact

Previous History —There was a history of the patient having fallen down on Feb 9, 1918, sustaining an injury to his right forearm He was treated for fracture of the forearm, and sent back to duty at the end of three weeks Being granted five days' leave he consulted his family doctor because he was unable to move his forearm without pain and dislocation at the wrist His doctor noticed the tendency to dislocation

of the lower end of the ulna, and supplied him with a splint which was removed when the patient returned for duty He frequently reported sick and, as the result of a Special Medical Board, he was ultimately discharged from the army on Sept 6, 1919

Surgical Anatomy —The lower end of the ulna is excluded from the wrist-joint by the triangular fibrocartilage which is attached by its apex to the depression at the root of the styloid process of the ulna, and by its base to the medial border of the lower end of the radius This triangular cartilage is the only ligament in the lower radio ulnar articulation which maintains the ends of the bones in apposition, and moves with the radius—backwards on the lower end of the ulna in supination, and forwards in pronation The anterior and posterior radio-ulnar ligaments are weak, and have little influence in retaining the bones in apposition They extend transversely in front and behind the joint and limit its rotatory action
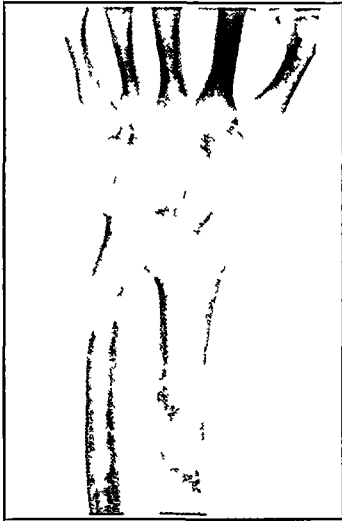
Pathology —Recurrent forward dislocation of the head of the ulna would appear to be an extremely rare condition, and is sometimes seen following violent trauma in this region Darrach,[1] in 1913, recorded a single case and referred to three cases described by Hoffa[2] and three by Courtin[3] , beyond a mere reference to its possibility the writer has failed to collect further cases

The essential lesion is not the lack of reduction, but the result of the imperfect repair of the triangular fibro cartilage which has been ruptured, or separated from its ulnar attachment by the tearing away of the styloid from the ulna close to its base The ulna head thus loses its stability, and a lax joint results This laxity may be only an abnormal mobility of the ulnar head, interfering but slightly if at all with the function of the wrist, or it may be sufficient, as in the case under review, to permit the head to slip out of the sigmoid cavity The impairment of function in this case was sufficient to warrant the carving out of the operative measures to be described later

In passing, it may be noted that dislocation at the lower radio-ulnar articulation as a complication of Colles s fracture is far more common, and whilst it is usually reduced with the fracture and a satisfactory result follows, the condition is sometimes not recognized until the swelling has disappeared and the splints have been removed

Uncomplicated forward luxation of the lower end of the ulna also occurs In working up the subject, Cotton and Brickley[4] collected and published the records of twenty-eight cases

Operative Treatment —Just as the symptoms of recurrent luxations differ considerably from those of the acute condition so in the case of treatment Operative treatment is practically never indicated in recent cases unless the condition is a complication of Colles s fracture, and open treatment is necessary to effect or maintain reduction

Fic)19 —Three months after operation

In recurrent cases however operation is an essential procedure

The writer not having access to surgical literature at the time devised the following operation (Dec 12 1919) An incision was carried down to the bone along the sub cutaneous dorsal border of the ulna in its distal fourth and then extended downwards to
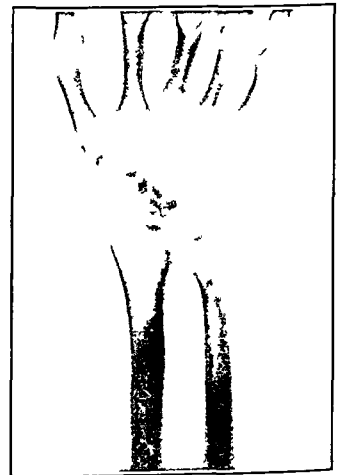
the level of the cuneiform   Having separated the ulnar periosteum, the lax capsular ligament of the lower radio-ulnar articulation was incised, its edges were retracted, and the detached styloid process of the ulna was removed   With an Albee saw, a sliding graft, 1½ in long and ⅜ in wide, was taken from the lower end of the ulna   The proximal end of the graft was trimmed and made more or less pointed in order to simulate a styloid process   The graft was turned round completely so that the proximal end became the distal, and projected for ¼ in beyond the lower end of the ulna (*Fig* 548) Interrupted 'looped' tanned catgut sutures passing through the periosteum and carpi ulnaris muscles on either side, fixed the graft   The edges of the lax capsular ligament were overlapped, and stitched with tanned catgut   The skin edges were united with interrupted silkworm-gut stitches   The hand, wrist, and forearm were controlled in a position of two-thirds complete pronation by means of a plaster-of-Paris case   At the end of four weeks the plaster was removed and the skin stitches were taken out   As the wound was well healed, massage and movements were started immediately   The patient was discharged eight weeks later with a strong and useful wrist (*Fig* 549)

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[1] DARRACH *Ann of Surg* , 1913, lvii 928
[2] HOFFA, *Verhandl der Deut Gesellsch f Chir* , 1898, Pt i, 156
[3] COURTIN, *Gaz hebd des Sci med de Bordeaux*, 1905, Oct 8, 481
[4] COTTON AND BRICKLEY *Ann of Surg* , 1912 March 368

MULTIPLE PAPILLOMATA OF THE SMALL INTESTINE CAUSING RECURRENT INTUSSUSCEPTION IN AN ADULT

By ZACHARY COPE, LONDON

A YOUTH, age 21, was admitted to St James s Hospital, Balham, in November, 1921, with a history of occasional attacks of violent abdominal pain On account of the pain his appendix had been removed at another hospital After admission he suffered from attacks of severe generalized abdominal pain and vomiting Between the attacks nothing abnormal could be found in the abdomen My colleague, Dr C E Lakin, was fortunate to see the patient during one of the attacks, and detected visible peristalsis On his suggestion I explored the abdomen on Nov 21 I found many coils of small intestine firmly adherent to the scar of the appendix-incision, and apparently causing some obstruction The adhesions were freed with some difficulty and the abdomen was closed

Early in the morning of Nov 27, he was taken with acute paroxysmal abdominal pain, and vomited much bilious material The bowels had been regularly opened until the day of this attack, but no return came from an enema given after the onset of the pain When the paroxysms occurred the patient became pale and collapsed, and it was soon clear that some further interference would be necessary Abdominal examination showed a large tender lump in the left iliac fossa There was little difficulty in arriving at a diagnosis of acute intussusception The abdomen was opened by a paramedian incision and an enormous intussusception was found filling the left iliac fossa and the whole of the pelvic cavity The pelvic portion was almost impacted in the pelvis The diameter of the intussusception was between four and five inches, and the portion of gut involved was the middle of the small intestine Reduction was not difficult, and, when reduced, the affected part of gut was seen to be many feet in length Search was made for a tumour which might have caused the condition, and some soft lumps were felt in the bowel in that portion which had formed the apex of the invagination These lumps were very soft and movable, so one concluded they might be inspissated content of the bowel and closed the abdomen without further investigation

The patient progressed favourably until the thirteenth day after the operation Early in the morning of Dec 10, however, he was seized with another attack of acute abdominal pain, with vomiting and collapse In a few hours a lump was felt on the left side of the abdomen similar to that felt previously An additional observation on the second occasion was hyperæsthesia of the left iliac and left anterior lumbar regions

Operation was promptly undertaken and an almost exactly similar intussusception was again discovered, with the addition that there were many fresh adhesions between the congested intestine and the abdominal wall in the left iliac and lumbar regions Reduction was on this second occasion much more difficult, but was accomplished with only a few tears of the peritoneal coat of the bowel The same soft lumps were felt in the bowel at the apex of the invagination, so the gut was incised and one was removed It proved to be a pedunculated papilloma It was decided to remove the other swellings on a future occasion so the abdomen was closed Six days later, when the abdomen was re-opened very many soft and fresh adhesions made the operation extremely difficult but the former apex was identified and two more papillomata were removed by enterotomy No more tumours could be detected, but there may have been other minute papillomata which could not be felt Resection was out of the question since there were many extensions, the gut was very inflamed and one did not know the extent to which it might be affected by the papillomata The convalescence of the patient was uneventful but the prognosis can not be regarded as altogether satisfactory although microscopic report on the tumours pronounced them to be non-malignant

This case is recorded for three reasons —

1 Papillomata of the middle segment of the small intestine are very rare

2 Intussusception of the middle portion of the small intestine is excessively rare

3 The tumour formed by the intussusception was unusually large, and filled the pelvis like an impacted tumour

A SMALL POINT IN THE TECHNIQUE OF REDUCTION OF AN INTUSSUSCEPTION

As a rule no difficulty is experienced in the reduction of the main part of an intussusception by the accredited 'expression' method   There is often great difficulty however, in the reduction of the last portion   Judging by the great mortality and numerous resections recorded in some published series of cases, any slight assistance in reducing this difficult last portion deserves to be recorded   One need hardly apologize, therefore, for publishing a small manœuvre which I have practised for some years and found of great value in assisting the reduction of the last part of the invagination
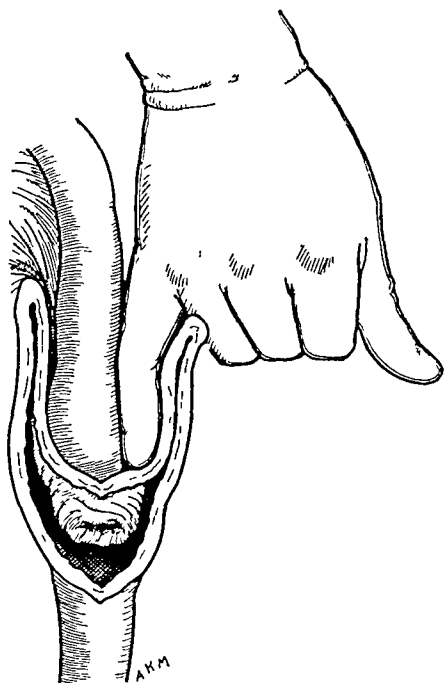
FIG 550 —Showing little finger inserted into the sulcus between the entering and returning layers of the intussusception   Adhesions between the two peritoneal surfaces are thereby freed
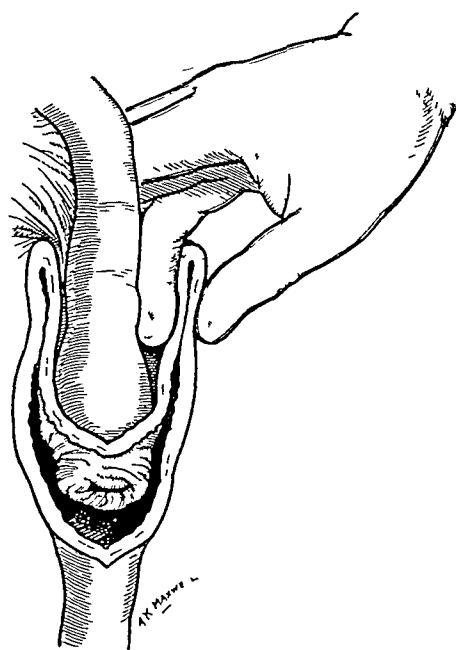
FIG 551 —Drawing to show how œdema is expressed from the swollen wall of the bowel

The procedure consists in introducing the little finger between the entering and returning layers of the intussusception (*Fig* 550)   It is largely due to the adhesions or friction between the two peritoneal surfaces of the intussusception that reduction is difficult   As a rule, no difficulty is experienced in inserting the little finger into the sulcus By this means some of the œdema may be expressed (*Fig* 551), and any adhesions freed or blood cleared   After that has been done a renewal of the usual method of reduction can be undertaken , in some cases it is even justifiable to exert a certain amount of traction on the proximal segment of gut so long as the entering and returning layers have been well separated

I believe if this little manœuvre is tried in any difficult intussusception there will be very few occasions—apart from actual gangrene of the gut—in which resection will be needed   In the case described above the method was found of use on the second occasion when reduction was difficult

VISITS TO SURGICAL CLINICS AT HOME AND ABROAD

THE CLINIC OF PROFESSOR RAFFAELE BASTIANELLI, ROME

THE great General Hospital of the city of Rome, the Policlinico, is a modern institution built on the pavilion system   Professor R Bastianelli, who has charge of one of the surgical services in the Policlinico, owes his excellent English to his American wife   His partiality for the Anglo Saxon race shows itself in the genuine pleasure and hospitality

FIG 552 —The Royal Institute of Clinical Surgery Policlinico Rome

with which he welcomes British surgeons to his clinic   We found that his admiration for British surgery was of no recent growth, but had given rise to an innovation in nursing in Rome which is destined to produce far-reaching consequences

Rather more than ten years ago, Professor Bastianelli, who had long been impressed with the inferiority of the nursing in Italian hospitals as compared with British or

American, formed a private Committee, consisting of the Princess Doiia Pamphrity Marchesa Muaini Gonzaga, and himself, to consider a pioject foi intioducing into Italy the English nursing system   As a first step it was decided to build a Nurses' Home in the centre of the Policlinico   The Committee obtained the patronage of H M the Queen of Italy, and with her help and with that of the hospital managers and the Prime Minister, Signor Giolitti, the Home was built, and opened in April, 1910   An English matron, Miss Dorothy Snell, was appointed, and she brought with her twenty English sisters and nurses Ten Italian proLationers were added to this service for puiposes of training , two pavilions in the Policlinico, one surgical and one medical, weie staffed with this personnel, and the experiment began

The course of training for Italian probationers was at first two years in duration In 1912 Italian certificated nurses trained in this service began to take the places of some of the English nurses, and in 1914 the first Italian sister was appointed   In 1916 it was found necessary to extend the course of training to three years

Iii   i a —The Nurses Home it the Policlinico

In its early days this innovation encountered much local opposition   There were many who did not share Professor Bastianelli's dissatisfaction with the standard of native Italian nursing then prevalent, and who regarded bed-sores in most serious cases as an act of God rather than as the result of incompetent nursing   Vested interests were of course roused, and the drum of local patriotism was beaten loudly in opposition to these alien invaders   But the diligence, ability, and tact of the Matron and of her staff little by little succeeded in making the new School of Nursing a great success and its fame spiead to such an extent that, during the war often the first request of a wounded Italian soldier on being transported to Rome was to be sent to the 'English Pavilion Ioday the staff is almost entirely Italian , the only remaining English people are the Matron, Assistant Matron and a night sister   There is a nursing staff of about 80 on duty in the units concerned, of whom 12 are sisters, and if it were not for the difficulty of displacing the former untrained men and women nurses, and the agitation of certain political organizations behind them, the School would have made still greater headway

That the experiment is a successful one is proved not only by the fact that the pavilions staffed by the School nurses have been recognized by the authorities and by doctors is the best in Italy, but also by the conclusion of a Royal Commission appointed to study the problem of the nursing service in Italy. The Commission concluded that the Scuola Convitto Regina Ilena in Rome should be taken as the standard for future Schools to be founded in Italy.

Professor Bastianelli's operating theatre is rather small, with excellent light. The theatre staff consists of 1st assistant (a 'long-service' man), 2nd assistant, instrument sister (an Italian, trained in the British tradition by the sisters brought over by Bastianelli eleven years ago), probationer, and male theatre attendant. The general aseptic technique is on usual modern lines. Alcoholic solution of picric acid is used for sterilizing the skin, and smooth rubber gloves are worn.

On the morning of our visit, the Professor operated on four cases, and the details of his technique are described in the following paragraphs.

Case 1 —Carcinoma of pylorus partial gastrectomy

The patient, a man, gave a history of a sense of weight and pain in the epigastrium for four or five months, and there was a large movable tumour in the right epigastrium.

OPERATION.—A mid-line incision was made above the umbilicus. The growth in the pyloric end of the stomach was large, but fairly movable. Professor Bastianelli, after some hesitation, decided to remove it, and began the gastrectomy at the cardiac end. He first tore through the small omentum, and placed two heavy Spencer Wells' forceps on the coronary artery about one third of the distance down from the cardiac orifice to the pylorus. The coronary artery was divided between these and tied with catgut on a transfixion needle. The left end of the great omentum was then divided between Kocher's forceps, and tied off with catgut which gave a good deal of trouble by breaking. Two curved gastrectomy forceps were next placed on the stomach high up to the left, one inch apart, and—after packing off—the stomach was divided by knife between them, close to the lower clamp. The exposed mucosa was swabbed with tincture of iodine. The rest of the great omentum was next divided between Kocher's forceps and tied off, and the stomach turned down to the right exposing its posterior wall. The posterior aspect of the growth was freed from the pancreas by the method of scissor dissection so often employed by our gynaecologists. The pyloric vessels were divided between forceps. At this point there was rather severe haemorrhage from either the gastroduodenal or splenic artery, which took some little time to control. The first part of the duodenum was now divided between clamps. The Professor contemplated a direct union of the divided duodenum with the stump of the stomach, which is apparently his favourite method. After testing the mobility of the two parts, however, he decided that he had stripped the posterior wall of the duodenum too much and left it too thin to hold sutures under some tension. Accordingly he abandoned the idea of a Billroth gastrectomy, and decided on the precolic Polya method. The duodenum was closed in two layers with catgut. A straight needle was used for the haemostatic suture, and a curved needle with interrupted sutures for the Lembert. Curved clamps without rubber covering were applied longitudinally to the first loop of jejunum. (The clamps left on the stomach stump were rubber covered.) The proximal end of the jejunal loop was approximated to the greater curvature of the stomach, and the distal end to the lesser curvature. For the seromuscular stitch silk on a curved needle was used. It was carried along the whole length of the posterior wall of the stomach and clamped jejunal loop and tied off. The lumen of the stomach was now reduced by a second Lembert stitch of silk

Fig. ... —Professor Raffaele Bastianelli operating.

carried half-way up from the greater curvature, so as to make a stoma half the size of the gastric lumen, lying close to the lesser curvature An incision of corresponding size was made in the upper (distal) half of the jejunal loop The through-and through hæmostatic suture was catgut on a straight needle He began it at the lower end on the greater curvature, as a continuous Lembert On reaching the lower end of the stoma it became a continuous through-and-through stitch, and so up to the lesser curvature For turning the corner, and for the anterior layer, it became a mucous loop stitch, and at the lower angle of the stoma was carried on again as a seromuscular to meet its commencement at the greater curvature, where it was tied off The clamps were now removed and the anterior layer of the original seromuscular suture of silk was brought down the whole distance from the lesser to the greater curvature

In closing the abdominal wall four interrupted tension stitches of thick silk were passed through all layers including peritoneum and left temporarily untied A row of interrupted catgut was used for peritoneum and linea alba, and continuous catgut on a curved needle for the skin The four tension stitches were finally tied over a roll of gauze

The whole operation took one hour and forty minutes We learned two days later that the patient was making a good convalescence

Case 2 —Duodenal ulcer

A right paramedian incision was made, and a typical ulcer in the first part of the duodenum exposed The ulcer was not excised but was infolded with interrupted catgut Posterior gastro-enterostomy was performed, and curved, interlocking clamps uncovered by rubber were employed A rather long jejunal loop was left above the stoma For the outer layer silk on a straight needle was used The Professor men-
tioned that he did not believe
that silk or other non absorb-
ible stitch is the chief cause of
gastrojejunal ulcer On opening
the stomach, vessels in the sub
mucosa were picked up by
artery forceps before the mucosa
was laid open The anterior
layer of the hæmostatic stitch
was inserted as a mucous loop
The stitching was very close,
approximately twelve to the
inch A straight needle was
used for both layers The
stoma was placed horizontally
on the posterior wall of the
stomach, and the mesocolon
sutured to the stomach close to
the anastomosis at the comple-
tion The abdomen was closed
without inspecting the gall-
bladder, appendix, or other
organs
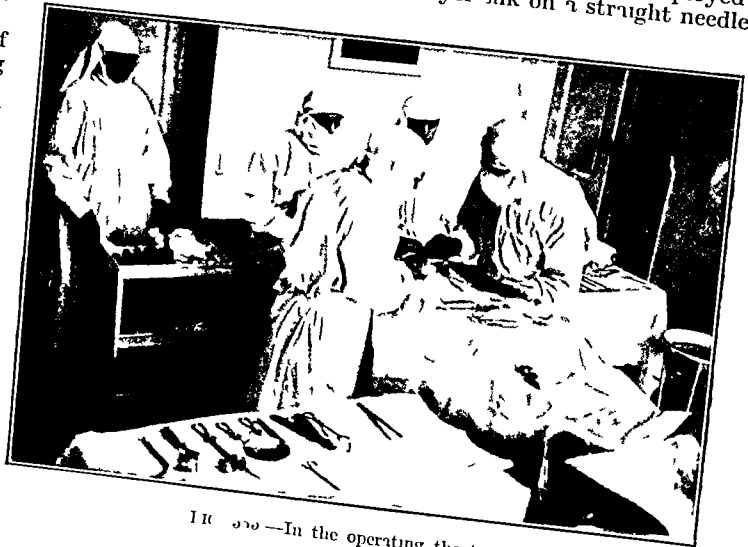
We noticed later that other
surgeons in Italy very commonly omitted the wide general inspection of the abdominal viscera
that is considered so desirable by British and American surgeons, and were content to deal with
the main lesion alone

Fig. 559 —In the operating theatre

Case 3 —Carcinoma of the left testis

There was a four months' history of swelling With the patient in the half Trendelenburg position a groin incision was made, extending from the upper scrotum parallel with Poupart to above the anterior superior spine The external oblique was slit up from the external ring, and the cord isolated and clamped at the level of the internal ring before the tumour was manipulated The incision was now carried down on to the scrotum, and the testis (which was very large) dis-
sected out of the scrotum The abdominal incision was then prolonged up on the outer side of the linea semilunaris to the left costal margin The muscles were divided, the peritoneum was raised from the lateral and posterior abdominal wall, and retracted towards the mid-line The vas was separated from the spermatic vessels and divided The spermatic vessels were traced high up towards the aorta and divided No enlarged glands were found, but two or three apparently normal glands were removed from along the aorta The wound was then closed the only drainage being a small tube into the subcutaneous tissue of the inguinal region

Case 4 —Gall stones

The patient was a woman with a typical history of biliary colic and jaundice
The incision was vertical through the outer part of the right rectus, and the upper end was

prolonged obliquely upwards and inwards, parallel with the costal margin   Tongue forceps were used to grip the gall-bladder   The cystic and common duct were dissected out with long curved scissors , cholecystectomy was performed, starting by a division of the cystic duct and artery and the gall-bladder fossa on the liver was covered in by interrupted catgut stitches   Before ligaturing the cystic duct a flexible probe was used to explore the common and hepatic ducts, which were free from stones   A split drainage tube, with a gauze wick was left in the sub hepatic fossa

Dr Sgambati, the pathologist in Professor Bastianelli's Clinic, described to us a test for perforative peritonitis which they had used empirically for some time, and to which they attached considerable importance   Into a test-tube containing the patient's urine, strong nitric acid is poured as in the ordinary test for albumin, and if the test is positive a brownish-purple colour appears above the nitric acid for some depth   He stated that it was never found in intestinal obstruction alone , that it appears within two hours after perforation of an abdominal viscus , but there is a slight reaction the day after any abdominal operation   The chemical significance of the test is not understood

The writer was fortunate enough to attend one of Professor Bastianelli's classes in clinical surgery   The patient was on a couch in the centre of a large lecture theatre, the Professor sat in a chair by the side of the patient, and two students were called down to examine the case   There were a hundred and twenty students in the class, nearly all men   The patient had a large ovarian cyst, and the Professor made the two students go through the ordinary physical examination, discoursing to the class at intervals upon the precise significance of the various methods of physical examination, and then upon the differential diagnosis, pathology, and treatment of the condition   Whether the Italian medical student is a more tractable individual than his British *confrere*, is a matter of uncertain speculation , but it is an undoubted fact that Professor Bastianelli held his large class of students in a state of active attention during the whole of his dissertation, and it was a remarkable proof of this interest that the percussion notes were perfectly audible at the back of his large audience

SHORT NOTES OF
RARE OR OBSCURE CASES

INVERSION OF THE VERMIFORM APPENDIX

By ARTHUR EVANS, London

A FEMALE, age 33, was admitted into hospital Sept 29, 1919

HISTORY—The patient stated that she had been losing weight for the previous twelve months   For the first six months of that time her periods came on every fourteen days, and each period lasted till the beginning of the next   For the last six months she had been quite regular, each period lasting from five to seven days

She had suffered no abdominal or pelvic pain , the bowels were regular, and she had sought admission into the hospital solely on account of the loss of blood and loss of weight

ON ADMISSION —A slight swelling could be felt above the pubes   Vaginal examination revealed a swelling in Douglas's pouch

OPERATION —At the operation the contents of the pelvis were found matted together   The bladder was closely united to the uterus, and the line of junction was hidden by a firmly adherent coil of small intestine   These structures were freed, and the Fallopian tubes and ovaries identified   These were fused into one thickened and adherent mass   On the left side an abscess cavity was opened

Both tubes and ovaries were removed   At the conclusion of the operation, as a matter of routine, the cæcum was drawn into the wound and inspected, when it was discovered that the appendix was inverted

FIG 7 —The appendix showing congestion of the mucous membrane (Natural size)
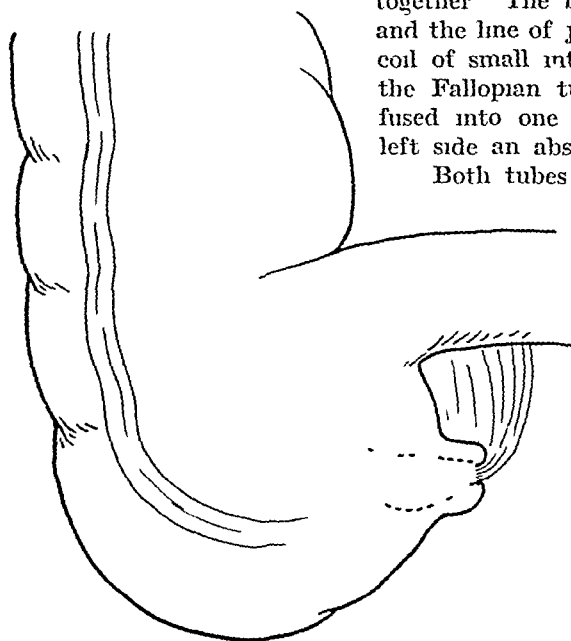
FIG 6 —Showing the position of the inverted appendix at operation

presenting the appearance shown in Fig 556   The tip could be felt within the cæcum   The inversion was not reducible   The meso-appendix was clamped and cut   and a circular incision made round the base of the appendix   when this was done the appendix became wholly inverted (Fig 557)   This specimen is now in the museum of the Royal College of Surgeons

The distal half was congested, and at the extreme tip hemorrhage had taken place into the tissues

No history was obtained referable to trouble with the appendix

DUPLICATION OF THE URETER

By GEOFFREY KEYNES, London

DUPLICATION of one or both ureters is not a very uncommon condition, though the abnormality is more often incomplete than complete   Different authorities have estimated that a double ureter occurs in from 1 to 4 per cent of all diseases of the urinary system In many cases the condition is only discovered at autopsy, having given no trouble during life   In the following case the patient's illness, which was directly due to this abnormality, ran a very obscure course and an unusual state of affairs was revealed after death

The patient was a single woman, age 26   Previously she had always enjoyed good health , but one month before admission to hospital had noticed a swelling in the left side of her abdomen   This swelling had increased in size and become tender   For several days she had felt feverish   On examination, a large cystic tumour was felt in the left hypochondrium extending from the costal margin to three inches below the umbilicus   The tumour was thought to be of renal origin, but in the absence of any other signs or symptoms, no certain clinical diagnosis could be made   An exploratory laparotomy was performed by Mr G E Gask , but the tumour, extending from the left dome of the diaphragm to the brim of the pelvis, was found to be too large for removal The fluid contained in it was accordingly evacuated, three pints being obtained, and the cavity was drained through the abdominal wall   An examination of this material threw little light on the nature of the tumour   It was a thin turbid fluid containing many pus cells, some red blood cells, and a few doubtful Gram-negative micro-organisms   No growth was obtained on culture   The urea content was estimated by Dr George Graham and was found to be 55 mgrm per cent—an amount such as would be found in any of the body fluids   It seemed improbable, therefore, that this fluid was of renal origin, and the diagnosis remained obscure   After the operation the general condition of the patient became steadily worse, and she died after three days with all the symptoms of a profound toxemia, with incessant vomiting, and very scanty urine which contained much acetone

The post-mortem examination revealed an interesting condition   All the organs were found to be normal except the urinary tract on the left side   The lower part of the left kidney appeared normal, and a normal ureter proceeded from the hilus   The upper part, however, was occupied by the large cyst which had been tapped at the operation, and was now much reduced in size   From this proceeded a second ureter, dilated and tortuous   The lumen of this communicated with the cyst above, but it was obliterated at several points in its course within the pelvis, so that it was represented by a series of distended loculi, all of which contained a considerable amount of thick yellow pus   One of the loculi had bulged between the layers of the broad ligament and was in contact with the left side of the uterus   The loculus below this was in intimate contact with the wall of the bladder   it penetrated the muscular layers so that its wall was only separated from the lumen of the bladder by the mucous membrane , but there was no indication that it had ever possessed any opening through this   The point of closest contact with the mucous membrane of the bladder was a little below and in front of the opening of the normal ureter   Further loculi extended into the substance of the wall of the vagina but again without opening into it, and there was no evidence that any such opening had ever existed   The accompanying drawing (Fig 558), made from a dissection of the parts, shows the course and relations of the second ureter

The patient, therefore, had a complete duplication of the ureter on the left side, but the upper or abnormal ureter had never communicated with the bladder or any other part of the genito urinary tract   A hydronephrosis of the upper part of the left kidney had resulted, and this, presumably, had been present since birth   At the same time the abnormal ureter had become dilated and tortuous, and adhesions forming within its lumen had divided it up, in the course of time, into a series of loculi   This suggests that a chronic infection of the tract, possibly travelling through the wall of the vagina, had been present for many years, but of so mild a degree that the patient believed herself to

be in good health   In the end, however, the infection assumed a more virulent character, so that the ureter was converted into a series of abscesses   At the same time there was a great and rapid increase in the amount of fluid in the cyst which represented the upper pole of the left kidney   All trace of kidney tissue, however had disappeared, probably long before, from the walls of the cyst, and consequently the fluid secreted no longer resembled urine in its chemical constitution   Drainage of this hydronephrosis did not relieve the patient, who possessed a number of other pus-containing cysts in situations unsuspected and difficult of access Death from toxemia was accordingly the natural termination

The abnormality conformed to the type most commonly found, in that it was on the left side, and involved the upper pole of the kidney   Usually, however, the additional ureter has an opening below into the bladder, vagina, or urethra, whereas in the present case there was no opening, so that a hydronephrosis inevitably resulted   Even when the opening is present a hydronephrosis may nevertheless develop A case of incomplete duplication of the left ureter with intermittent hydronephrosis followed by pyonephrosis was recently recorded by Pizzetti [1] An interesting specimen, which has not been described in the literature of the subject, is preserved in the museum of St Bartholomew s Hospital This was obtained from a man, age 50, who died from cerebral hæmorrhage   Both ureters are completely duplicated, and all four open into the bladder, but the more posterior ureter on each side has formed a considerable pouch in the wall of the bladder and is dilated in its whole length   On the

A Cystic portion of left kidney   The interior wall of the cyst has been cut away   B Abnormal ureter   C Dilated loculi of abnormal ureter   D Cut edge of peritoneum forming anterior layer of broad ligament   E Normal left ureter   F Left uterine artery   G Uterus and left fallopian tube   H Bladder   I Normal right kidney and ureter

FIG 98 – Diagram to show the duplicated ureter

left side the abnormal arrangement has caused some obstruction to the outflow from the second ureter so that both are dilated and the kidney is hydronephrotic in addition The same has occurred to a much slighter degree on the right side

Hydro- and pyonephrosis is, therefore, not a very rare complication of double ureter, but it is unusual for the patient to die as a result of this alone, and the condition may be exceedingly difficult to diagnose

[1] Policlinico (Sez Chir), 1921 April 15

REFERENCE

EXOPHTHALMIC GOITRE   DEATH FROM BILATERAL FEMORAL THROMBOSIS AND GANGRENE

By W. G. SPENCER, London

A FEMALE typist, age 21 was admitted to the Westminster Hospital on Sept 17, 1917 She had had a gradually increasing swelling of the thyroid gland for three years, and had lost over a stone in weight during the last few months She had become breathless when going upstairs and had occasionally awaked at night with distress in breathing But she had not been troubled by palpitations or by difficulty in swallowing

The thyroid gland was uniformly enlarged and firmly elastic its margins were not well defined, but it moved with the larynx There was marked bilateral exophthalmos, with von Graefe's sign present The pulse was feeble and irregular averaging 108 No cardiac murmurs could be heard

The patient was kept in bed from Sept 17 to 28 she showed nervous excitement and blushed on slight provocation The pulse-rate continued unaltered at 108, the temperature rose at night to 99 5° She was very restless at night, and also by day The bowels acted regularly The urine was normal

Sept 28 —About three-quarters of the right lobe of the thyroid was removed, and also the isthmus There was no excessive hæmorrhage The depressor muscles were united as well as the skin, except for a small tube removed on the following day The operation appeared to be well borne but for the next three days the patient was extremely restless in spite of drugs, bromide and chloral, and morphia

Sept 30 —The wound was dressed and looked perfectly well—pulse-rate 120, temperature 99°

Oct 1 —The fourth day after the operation, the left leg was painful and cold with marbled skin, there was no pulsation in the dorsalis pedis or in the popliteal artery but the left common and superficial femoral could be felt pulsating for at least three inches below Poupart's ligament

Oct 2 —The right lower extremity was in the same state as the left had been on the previous day Pulsation in the left femoral artery could only be felt just below Poupart's ligament

Oct 3 —The left leg presented several separate patches of skin becoming gangrenous

Oct 5 —The right leg showed patches of commencing gangrene

Oct 6 —On the left side pulsation could be felt for one inch below Poupart's ligament, on the right side scarcely any pulsation could be felt in this place Both limbs were quite cold up to the knee, above which the circulation seemed sufficient There was no voluntary movement in the toes or legs Deep pressure at the ankle could be felt There were dark purple, dry, and hard gangrenous patches of skin on both sides as high as the knees

Oct 7 —There was no pulsation below Poupart's ligament on the right side, slight pulsation in the left common femoral The patient had continued very restless, the pulse and temperature remaining unchanged The operation wound had healed

Oct 8 —As the patient began to die the temperature rose, the patient continuing restless to the end

POST-MORTEM EXAMINATION —This took place twelve hours later, and revealed the following conditions —

Heart —The left ventricle was hypertrophied All the four chambers were filled with agonal clot In the left ventricle near its apex there was a granular adherent intemortem clot the size of an almond

Lungs —These were slightly congested, but otherwise normal

Kidneys —Infarctions were found in both kidneys recent on the right, old on the left side

Lower Extremities —Thrombosis was present in the femoral arteries and veins of both sides   In the right common femoral artery the clot was moderately firm, pale, and extended upwards to the bifurcation of the common iliac   The clot on the left side was softer and more red

Examination of the Portion of Goitre Excised —The tissue was composed of small follicles , there were only a few large ones   The small follicles were mostly devoid of colloid, the larger were filled with it   The follicles had mostly cuboidal epithelium although in places it was columnar   The interfollicular tissue was of moderate density

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SEVEN LARGE SEWING-NEEDLES IN THIGH

By W G SPENCER, London

The following case depended for its successful issue wholly on radiography   A man complained of pain in the right thigh, but there was nothing to be seen or felt   The radiograph reproduced (*Fig* 559) was taken by the sister acting under Capt Robert Knox   It was thus discovered that there were seven large sewing - needles, each nearly two inches in length, in the quadriceps extensor muscle about the middle of the thigh, external to the line of the artery   All had been pushed in, with their points directed upwards, almost in the course of the muscle fibres until the eye ends were well beneath the aponeurosis   A curved flap of skin and subcutaneous tissue was turned up corresponding to the anterior flap of an amputation which exposed the aponeurosis overlying the needles   Even then no needle could be felt   The sister however, by means of the screen fixed the situation of the
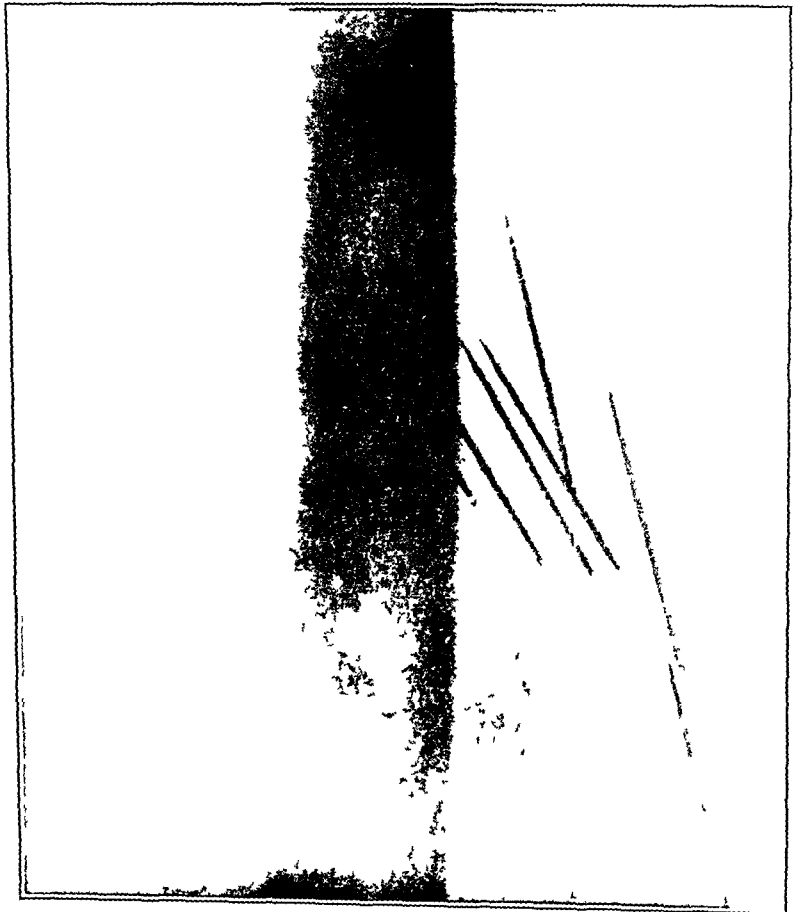
Fig 559 —Radiograph (lateral view) showing the seven needles in situ

eye end, so that each needle in turn was reached by a mere puncture through the aponeurosis   All were thus quickly extracted , the flap   after being sutured down healed by first intention and there was no complication

TRAUMATIC ANEURYSM OF SPLENIC ARTERY— RUPTURE—LIGATURE

By C. JENNINGS MARSHALL, London

THE following case is that of a revolver bullet wound of the abdomen

X Y, a married woman, age 27, was admitted to hospital on Jan 25, 1921 with the history that she had accidentally wounded herself while cleaning a revolver

She was very restless and pale, temperature 96 4°, pulse 102, and respiration 32 Immediately below the tip of the xiphoid, one inch to the left of the mid-line, was a small circular wound, depressed, and with slight blackening There was no external bleeding The upper abdomen was slightly rigid, and tender to pressure No dullness was made out on percussion

Laparotomy was performed, a left rectus-splitting incision was employed excising the entrance wound The track of the bullet was made out in the successive layers, and when the peritoneum was opened with the escape of five or six ounces of blood, was seen to pass through the left lobe of the liver, from entrance and exit came a moderate venous ooze, easily arrested by mattress sutures Deep to the liver was a perforation of the gastrohepatic omentum, the merest fraction of an inch from the lesser curve of the stomach The lesser omental cavity was opened and found also full of blood, the source of which was a hole drilled in the upper border of the pancreas, which was oozing slowly There was no fat necrosis A few superficial sutures of fine catgut were used to arrest bleeding here, and to close the opening in the gland with peritoneum A cigarette drain was left down to the hole in the gland, and the abdominal incision was closed

Convalescence was complicated by a pancreatic fistula which caused great soreness of the skin on discharge to a convalescent home in March the fistula had just closed

The patient was re-admitted on May 11 For three weeks she had been suffering from left hypochondriac pain, which had increased to a great extent during the past three days With this there was increasingly urgent vomiting The patient had a strained, exhausted look, retched or vomited every two or three minutes while under observation Pulse was 112 and very weak, temperature was 101 8°, and respiration 32 The wound was soundly healed, and devoid of the appearance of inflammation A distinct bulge could be seen in its lower part The epigastrium was rigid and very tender A suppurative process in the pancreas or in a pancreatic cyst was suspected

Laparotomy, May 12 —The old scar was cautiously incised On the deep surface of the parietes was found a rounded immobile tumour the size of a closed fist, attached to the abdominal wall in front by loose adhesions A pack was placed at the lower part of the incision where a small opening had been made into the general peritoneal cavity The tumour was then entered by blunt dissection, immediately a mass of recent dark blood clot was extruded followed by unclotted blood, and there was seen to be fierce arterial bleeding from the extreme depths of the cavity By finger-pressure downwards at what appeared to be the upper border of the pancreas, it was possible to control the flow completely The patient was becoming very collapsed and access to the source of the blood was almost impossible, owing to the narrowness of the costal arch, the heavy build of the patient and the dense adhesions It was very reluctantly decided to resort to the temporization of packing Flavine-soaked gauze was packed firmly on to the bleeding point and the cavity filled with similar material The wound was partially closed round this

The patient made a good recovery from the operation, though there was much pain and vomiting for two days The gauze kept superficially clean and bloodless and the evening temperature settled down to 99 6° On the eighth day however there was another attack of vomiting, disarranging the pack, and profuse arterial soaking of the dressing resulted It had been clear that the only chance of recovery lay in ligature and this was now forced upon one

Laparotomy —The stitches were removed, the incision was extended and protective packs were inserted   The gauze was removed cautiously—in its superficial part it was quite clean, but the deep part in contact with the pancreas was foul   Again the fierce bleeding occurred, and was at first arrested by digital pressure   The pack had enlarged the cavity so that access was somewhat easier, and now, by the aid of strong retraction it was found possible to get direct vision of the field   The bleeding was next controlled by the proximal pressure of a swab on a long holder against the cœliac axis   and was seen to come from a hole in a mass of inflammatory tissue at the upper border of the pancreas   Dissection by long, blunt-pointed scissors exposed the splenic artery at the bottom of this   there was a true aneurysmal sac the size of a green pea, ruptured at the left side   A stout catgut ligature was introduced on the proximal side and tied , the effectiveness of the anastomotic circulation was tested by release of the swab on the cœliac axis—the distal end of the vessel emitted a weak arterial spouting of blood   and was tied in a similar manner   Splenectomy, however, was not performed in view of this distal flow   The large cavity was lightly packed with flavine gauze, and the wound partially closed   There was considerable post-operative collapse   the control of bleeding   though vital to a clean exposure and ligature of the vessel, had been far from perfect—the assistant surgeon necessarily could not see what he was doing with the compressing swab-holder, and slipping was frequent , the point of compression, too   was uncomfortably near the site of bleeding

A satisfactory recovery   however, was made , the wound was frequently irrigated with flavine, and the gauze changed daily   The cavity was slow in contracting, and pancreatic leakage was again evident   Pain and vomiting were absent after this operation   appetite and colour returned, and the evening temperature had dropped to 100°   when on the sixteenth day there was a rigor with a temperature of 104°, and severe pain at the left costal margin   The left upper abdomen was rigid and exquisitely tender   The condition of the wound had not altered in any way , no enlargement of the spleen was to be made out nor any abnormal dullness in the lower costal or hypochondriac region   Sir J Charlton Briscoe kindly examined the patient and reported that there was no pleurisy, and no change in the lung except slight basal collapse   Three days later the condition was substantially unaltered save that it was thought there was slight dullness extending towards the left costal margin , the leucocyte count was 15 400   Some form of infection of the spleen had been thought likely (necrosis did not seem probable in view of the lapse of time, and of the condition of the distal circulation at the last operation), but now a subphrenic abscess, possibly secondary to splenic infection, was favoured

Operation, June 9, 1921 —A left subcostal incision was made half an inch from the costal margin   Packs were inserted on opening the peritoneum and an abscess was opened just reaching the edge of the ribs   About six ounces of thin pus was evacuated, and it was then seen that the cavity extended back and almost completely enclosed the spleen   There was no communication between it and the central wound   The visible splenic surface seemed absolutely normal, and the organ was neither swollen nor shrunken   The cavity was drained from the bottom

Again rapid improvement was evident   Both wounds closed down to narrow tracks but drainage was obstinately maintained by corrugated rubber kept down to the extreme depths of each

Nevertheless a fortnight later there appeared much cough, and the temperature shot up to 102°   Two days later several ounces of pus were expectorated   for four or five days more similar sputum was brought up   From this point progress was uninterrupted and   on discharge from hospital three weeks later to convalescence, there was only a fine pancreatic fistula at the middle wound

Health mended but slowly   at the end of three months the patient was getting about fairly well but the fistula persisted   There were however, other worries than ill health and throwing away the results of the fortitude with which so much suffering had been borne   she obtained final release with three others in a draught of champagne containing much cyanide of potash

A SACCULUS OF THE URINARY BLADDER WHICH RUPTURED DURING MICTURITION

By LENNOX GORDON, CAPETOWN

THE following clinical history brings out several points of interest —

The patient, a male, age 48, was admitted to the New Somerset Hospital under my care in June, 1921, complaining of acute abdominal pain. His previous health appeared to have been good except that he gave an indefinite history of 'occasional' attacks of difficulty in passing water noticed after a 'chill'. He had gone to bed on the night of June 28, feeling quite 'fit', and had risen next morning at 6 20 to pass water. He noticed that he had to strain while getting his water away, and during the act of straining he was seized with sudden acute pain in the lower part of the abdomen. He stated that he was able to finish the act of micturition in spite of the pain, and that he did not notice any blood in the urine.

He remained in bed during the day on account of the pain, but did not call in a doctor until late that night. He vomited once during the day. He was admitted to the New Somerset Hospital in the early hours of the morning of June 30.

The condition on admission as noted by the house surgeon was " that the patient complained of generalized abdominal pain, the maximal point of tenderness on palpation being to the left side of the middle line above the symphysis pubis. He was unable to pass water. A catheter was passed for diagnostic purposes and a stricture was encountered this was rapidly dilated, and on entering the bladder 26 ounces of blood stained urine were drawn off. The temperature was 100° and the pulse 96. An enema resulted in a constipated stool with the passage of flatus. After being catheterized the acute pain was relieved, and the patient became more comfortable'.

Next morning the symptoms had increased in severity. He vomited twice, and the pulse-rate rose to 120. A laparotomy was performed a few hours later. On opening the peritoneal cavity, blood stained urine, not in large quantities, was found. There was acute generalized peritonitis. An elongated bladder was found adherent to the anterior abdominal wall, extending up to a point midway between the umbilicus and the symphysis pubis.

Attached to the apex of the bladder was a sacculus which was adherent to the abdominal wall and showed a large ragged rupture on its posterior aspect which opened into the peritoneal cavity. The rupture was one inch long and irregular in outline.

FIG 560 —Post mortem appearance of the bladder after removal. The bladder has been opened from the anterior aspect. The rupture of the sacculus has been enlarged in the post mortem examination. (A) Sacculus with protrusion from bladder into sacculus. (B) Stricture of the urethra. (C) Position of opening of smaller sacculus hidden behind a fold of mucosa.

The tear was closed and buried with Lembert sutures. The peritoneal cavity was washed out with saline. A small extraperitoneal opening was made into the bladder above the symphysis for drainage. To drain the bladder by means of a urethral catheter was not attempted, owing to the urethral stricture which, I was told, was a very tight one and difficult to get through with even a small rigid instrument. The peritoneal cavity was closed.

The patient at the end of the operation was very much shocked The systolic blood-pressure immediately before operation was 105, and at the finish it had dropped to 45 He was immediately transfused with 1 pint of 6 per cent gum arabic solution, and this resulted in the blood-pressure being raised to 120 , but the recovery from the shock was only temporary, and the patient died a few hours later

The points of interest in this case are —

1 The well-marked sacculus resulting from urethral stricture

2 The fact that a rupture may occur in a thin-walled sacculus as the result of straining to pass water

3 The slight degree of involvement of the ureters and kidney pelves as the result of chronic back-pressure

4 The diagnostic significance of finding 26 ounces of urine in the bladder in which a rupture had occurred

This point can be explained, I think, by the fact that the rupture was at the apex of a large flabby bladder and that no overflow of urine had occurred until the bladder had filled itself, the urine being drawn off from the dependent portion of the dilated bladder The fact that this is the second case of ruptured bladder I have operated on within the past twelve months in which large quantities of urine were drawn off by catheter shows that an empty bladder is not of such diagnostic importance as one is apt to imagine

The following Report is taken from the description by Professor Bartlett of the specimen (*Fig* 560) in the pathological museum of the Cape Town University

A complication of gonorrhœal stricture of the urethra Ruptured sacculus at apex of urinary bladder Gonorrhœal stricture of membranous urethra

NEW SOMERSET HOSPITAL, P M No 25, 1921

The specimen shows a large sacculus or divert cu'um 4 cm in diameter, with a neck having a diameter of 0 5 cm projecting from the apex of the bladder There is a second smaller sacculus on the right hand side of the base of the trigone The muscular wall of the bladder is hypertrophied, and there is a narrow fibrous stricture of the membranous urethra The large sacculus ruptured during life when the man was straining to pass water He was operated on, and the rupture was sutured, but the patient died of general peritonitis

The back pressure had not involved ureters or kidney pelves to any marked degree The wall of the sacculus does not contain muscle the mucosa and submucosa pouc es through a gap between the muscle bundles of the bladder wall Sacculus formation is common, but rupture of a sacculus is very rare

My thanks are due to Professor Bartlett for permission to publish the post-mortem notes of this case

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A CASE OF REPEATED ABDOMINAL SECTION FOR INTESTINAL OBSTRUCTION, WITH SOME UNUSUAL FEATURES

By A H BURGESS MANCHESTER

ON December 23, 1912, I was asked to see, in consultation with Dr Rothwell, of Hale Mr F S age 35 who had been seized forty eight hours previously with acute epigastric pain followed shortly by vomiting and who was obviously suffering from acute intestinal obstruction correctly diagnosed by Dr Rothwell as being due to an intussusception A swelling could be felt along the course of the transverse colon, ending under the left costal margin He was at once transferred to a nursing home where I opened the abdomen through a vertical incision splitting the fibres of the left rectus , the swelling proved to be an intussusception of the colon This was reduced with some difficulty, when its apex was found to be constituted by a malignant growth of the transverse colon arising 4 inches

from the hepatic flexure   With a view to its later removal I performed lateral anasto-mosis between the ileum—6 inches from the ileocæcal valve—and the lower end of the descending colon   The incision was closed in layers without drainage, the obstruction was relieved, and the wound healed primarily

On January 5, 1913, I again opened the abdomen, this time by splitting vertically the fibres of the right rectus, and excised all the bowel between the two portions laterally anastomosed at the first operation, that is to say, the last few inches of ileum, the cæcum, the appendix, and the colon down to the lower end of the descending colon   along with the lymphatic areas of the ileocolic, right colic, middle colic, and part of the left colic arteries   also many enlarged glands were removed with the mesenteries   Both divided ends of the bowel were ligated and invaginated   the wound was again closed in layers without drainage   The parts removed were examined by the late Professor Delepine who reported that " The growth is a malignant adenoma, the coats of the bowel being deeply invaded , but the peritoneal coat has not been reached   Three lymph glands have been examined but show inflammatory changes only '

The wound healed primarily, and the patient's condition was very satisfactory until January 28, when he commenced to have recurrent attacks of severe intestinal colic These persisted, the abdomen became distended and his general state deteriorated so rapidly that three days later I again performed laparotomy, this time in the median subumbilical line   Distended small intestine was traced down to near the site of the ileocolostomy of the first operation, but owing to the extremely grave condition of the patient, the exact cause of the obstruction was not determined, and a lateral anastomosis was rapidly performed between the lowest coil of distended gut and an adjacent collapsed coil of ileum   This relieved the obstruction , the patient recovered steadily, and left the home on February 21

His general condition gradually improved, and he remained well until June 12, 1915 when at 1 p m   he was suddenly seized with the most acute epigastric pain, soon followed by vomiting and extreme abdominal distention   He was re admitted to the nursing home, and I again opened the abdomen through the right rectus below the umbilicus   A large amount of deeply blood-stained serum escaped, and two feet of small intestine were found tightly strangulated under a band close to the ileocolostomy   on dividing the band the bowel showed no signs of recovery, so the strangulated portion which, it is interesting to note, included the lateral anastomosis of the last operation, was resected   The distal line of division of the gut was found to be within an inch of the ileocolostomy, so the distal end was simply ligated and invaginated, the proximal end being implanted laterally into the colon just beyond the site of the ileocolostomy   the wound was closed without drainage   Progress was quite satisfactory until the twelfth day, when, after removal of the sutures, it was noted that the lower end of the wound bulged slightly   On opening up this portion with sinus forceps a black slough was visible, which on extraction proved to be a piece of gangrenous small intestine, 6 inches in length, with the corresponding wedge-shaped portion of the mesentery   Its removal was followed by a gush of fæces and for several days all the fæces escaped at the wound   the fæcal flow then gradually diminished and entirely ceased on July 12, the wound healing by granulation   He returned home, but on August 6 was again admitted with severe colic, vomiting and extreme abdominal distention   I opened the abdomen for the fifth time—through the left rectus below the umbilicus—and found a coil of small intestine adherent to the mesentery and sharply kinked   The adhesion was of recent formation, and was easily separated with the finger, the obstruction being at once relieved   On this occasion, as the general condition of the patient was fairly good, and bearing in mind the previous history of the case, I made a careful examination of the viscera   With the exception of the adhesion which had caused the recent obstruction, the abdomen was absolutely free from any trace of adhesion   Search was made to discover the site in the gut whence the gangrenous portion had been eliminated after the fourth operation , but so completely had Nature restored the continuity of the bowel and mesentery, that one could not say defi-nitely where it had been previously interrupted   Remembering that the cause of the

original obstruction was a malignant growth, I searched for signs of recurrence, but the only suspicious element was a single enlarged gland close to the site of the ileocolostomy I removed this gland, but on histological examination by the late Professor Delepine it showed inflammatory changes only The wound was closed in layers without drainage the patient made a quick recovery, and returned home on August 24 Since then he has remained free from obstruction, and at the present time, nine years after the first operation, is in good health the lower abdominal wall presents five parallel vertical scars, but is quite firm

The chief feature of interest in this case is in connection with the spontaneous elimination of the gangrenous piece of gut twelve days after the fourth operation The wedge shaped portion of mesentery attached to it suggests some circulatory disturbance as the cause of the gangrene—probably embolism or thrombosis of one of the smaller mesenteric arteries, and the various intestinal resections and anastomoses that had been performed must have materially affected the circulation to the remaining gut For some days, the gangrenous intestine must have served passively to conduct the fæcal current without producing any symptoms of obstruction After its spontaneous separation the two ends of the bowel must have come into almost exact apposition and formed a perfect ' end-to-end ' union Considerable adhesions must have been present at this time, fixing the bowel to the peritoneal aspect of the wound and shutting off the general peritoneal cavity, and yet two months later, as disclosed at the fifth operation not only had the bowel loosened itself from the inner aspect of the wound so completely as to leave no trace of having ever been adherent there, but the union of the ends of the bowel and mesentery had been so perfect that its site could not be detected

This reparative effort on Nature's part seems worthy to be placed on record

REVIEWS AND NOTICES OF BOOKS

Technique of the Teat and Capillary Glass Tube being a Handbook for the Medical Research Laboratory and the Research Ward   By Sir ALMROTH E WRIGHT, M D F R S , with the co laboration of LEONARD COLEBROOK, M B , B S   Second edition   Large 8vo   Pp xxvi + 384   Illustrated in colour and in black and white   1921   London   Constable & Co Ltd   42s net

THOSE who were acquainted with this book in its original form will welcome a second and much enlarged edition   In its general character they will find the work unchanged, but its scope is increased by the inclusion of much new matter   It is always a pleasure to read anything by Sir Almroth Wright, on account of the delightful if unusual style in which he presents his subject He is, it is true, addicted to the coinage of new terms , but these, he might tell us, are necessary because they stand for new ideas   We cannot, however, pass without remark his spelling 'pathogennesis'   Liddell and Scott certainly afford ground for spelling it either with one *n* or two but it is surely somewhat of an affectation to depart from the customary usage

We may always turn to a preface by Sir Almroth, as we do to one by Bernard Shaw, with the assurance that we shall find food for reflection, and we are not disappointed I ere   He sets out to persuade us that real progress in treatment is to be expected solely, or almost solely, from the application of laboratory methods, and that clinical experience and statistical evidence are, in comparison, of little service   So persuasive is the charm of his style that, as we read, we are content to acknowledge the truth of much of his reasoning, though we think that he overstates his case   A surgeon might justly retort that the treatment of infected wounds during the war was a story, if not of failure, at least of only partial success, so long as they were dealt with on the lines of laboratory teaching   It was not until the surgeon took matters into his own hands and cut the infected tissues right out, that real success was achieved   We make these remarks not with the smallest wish to undervalue laboratory methods, which we firmly believe to be indispensable for surgery as for medicine, but because we think Sir Almroth Wright goes too far in proclaiming their exclusive virtue   Surgery, is an art, applies every science which can serve its ends , it is not based on any one alone though it is true that it finds its surest ground in pathology

The work under review is one essentially for the laboratory man, though the writers have incorporated three clinical appendices to chapter 7, dealing with the coagulability, alkalinity and antitryptic power of the blood in a manner which is of direct interest to the surgeon   In the main the book explains, lucidly and with a wealth of admirable illustrations, the whole of the ingenious laboratory technique which has been evolved at St Mary's Hospital under the inspiration and guidance of Sir Almroth Wright   It is a technique of somewhat peculiar kind, specially designed for the examination of minimal quantities of the blood or other body fluids   Such methods possess a manifest advantage in securing the material needed from a single drop of fluid, and it is claimed that the manifest disadvantage of relative lack of accuracy in measurement has been overcome by the device of counting pipettes and slides with a thin layer of paraffin described for the first time in this edition   One is lost in amazement at the extraordinary ingenuity which has been brought to bear on the devising of the technique and on the overcoming of the little difficulties which constantly present themselves to the laboratory worker   This is a book which no such worker can afford to overlook, for, whether he employs the 'micro technique' or not, he will find, almost on every page, 'tips' which will be invaluable to him in his daily work   The methods are described with such clearness that anyone who can use his hands should be able to carry them out after a reasonable amount of practice

The test of a good laboratory technique is that it should suffice not merely for the daily routine of clinical pathology, but for the elucidation of more far reaching principles of permanent value   And it must be admitted that in the hands of its originator this technique has led to the establishment of such principles, of which two may be mentioned is examples   Wright's application of the idea of measuring phagocytic power, first suggested by Sir W B Leishman, led to the conception of the opsonic index, and indirectly to notable modifications in the dosage of vaccines and tuberculin   Again his studies on the conditions affecting blood coagulation have gone far to place the treatment of certain forms of hæmorrhage upon a surer foundation   Others may prefer a technique which deals with larger volumes, and indeed although the St Mary s methods have been before pathologists for many years, and although the principles of many of them have been widely adopted, the micro technique itself has not come into general use elsewhere   But at least the methods described in the present volume must be admitted to have proved themselves adequate for research no less than for routine use

In the preparation of this edition, Sir Almroth has had the collaboration of Dr Leonard Colebrook, one of his well-known disciples. New chapters have been added on subjects arising from studies on wound infections during the war including the emigration and functions of leucocytes. The book makes no pretence at covering all the fields of laboratory work, being, indeed, almost limited to those in which Sir Almroth himself has laboured. It is a 'personal' work, strongly reflecting its author's individuality, and the many friends who know and admire Sir Almroth, even though they may not always see eye to eye with him, will be glad to possess and read it.

Studies in the Palæopathology of Egypt. By Sir Marc Armand Ruffer Kt, C M G, M D, late President of the Quarantine Council of Egypt formerly Director of the British Institute of Preventive Medicine, Professor of Bacteriology in the Cairo Medical School, Member of the Indian Plague Commission, etc. Edited by Roy L Moodie Ph D, Associate Professor of Anatomy in the University of Illinois Imperial 8vo Pp 372, illustrated Chicago University of Chicago Press $7 50 net

This work is a memorial to Armand Ruffer. The material of it was provided by his own hands, the arrangement of it is the work of his widow and his friends. The preservation of mummies and of their viscera in Canopic jars, has made a study of their gross anatomy and pathology a comparatively easy matter. It was owing chiefly to the example and incentive of Ruffer that matters were carried further than this. By various methods of his own devising the mummified tissues were so prepared as to be available for the methods of examination by dissection and by the microscope that a pathologist of to-day could apply to them. Dr Roy Moodie, in the preface to this volume, says ' Sir Armand Ruffer made the first move towards establishing the science of palæopathology.'' It is a great claim and a just one. Pathological research owes much, and Egyptology something, to Ruffer. But in both sciences constant revision and sometimes revisal of opinions are necessary, and it is more than probable that many just criticisms that can be made of the statements, chronological and pathological, in this book would be unnecessary if a revision of it by Ruffer himself had been possible.

Throughout the volume there is an absence of reference to the authorities which a reader might himself like to consult. A little quotation will illustrate the point (p 30) Egyptian navvies of ancient times toiled practically the same hours as the Egyptians do now. They enjoyed a holiday every seven days as do many nations at the present time.'' What authority is there for this statement, which in its obvious relations is important ? We know of none. The fellah to-day when not under Europeans, works seven days a week.

One of the most interesting chapters in the book is that on dwarfs. Here Ruffer brings new material of great value, and dissipates errors that had been bred by others. Breasted whose work on Egyptology has earned the cordial acknowledgments of everyone, asserts that the dwarfs were representatives of a pygmy tribe existing in Yam (probably Central Africa), from whom captives were made from time to time. There is no evidence that the Egyptians ever went so far into Africa as this, and the dwarfs represented in all monuments are not pygmies but quite typical examples of achondroplasia. No one who saw the two photographs placed consecutively on the screen by Sir Berkeley Moynihan in his address at the Royal Society of Medicine last December can have the least hesitation in accepting this statement. The first slide was a photograph of two children suffering from achondroplasia, the second a photograph of three statues of the god Ptah and an Egyptian dwarf. Every detail in the configuration of the bodies heads, and limbs was identical. Ruffer is here certainly right and Breasted wrong.

In his description of the famous 'dwarf of Zer (*Plate LIII Fig 2*), Ruffer speaks of the drawing as wonderfully spirited' This is true. We are only now beginning to realize the greatness of Egyptian artists. The collection exhibited last year by the Burlington Fine Art Society contained works (the majority of the specimens were the property of the Earl of Carnarvon) which were astonishing in their beauty accuracy, and qualities of delight. Ruffer speaks of this figure is foreshortened. This is inaccurate. Foreshortening was never attempted by the Egyptians, they were always truthful, so far as the limits of their art allowed them. Ruffer indeed, had no great knowledge of Egyptian art. He speaks of difficulty in deciding the exact nature of the condition afflicting the Queen of Punt (p 45) and says. The problem is rendered more difficult by the fact that the legs abdomen and head are drawn in profile and the chest almost full face. This is the case with every Egyptian drawing or bas relief when depicting the human figure so why make the exception here ? The missing portion of the bas reliefs showing the daughter of the Queen of Punt which has unfortunately been lost is in the collection of the Earl of Dufferin in Ireland.

The chapter on histological studies in Egyptian mummies is full of interest. The difficulties of preparing the material for examination were evidently considerable and Ruffer concludes that no pathological diagnosis dependent upon a recognition of *cellular* changes is possible but that microscopical examination may reveal changes due to infiltration of the tissues by new growths inflammation, cirrhotic conditions parasites atheroma and calcification. A doubt is left in the mind of the reader of this chapter as to whether the material Ruffer had to work with was the best possible. The specimens seem to have been poor perhaps rightly so at the beginning of his

investigations, but his success with poor material was an ample warrant for the provision of the very best material available, and this he never appears to have had

An examination of the bones of mummies reveals interesting results   Tuberculous disease was extremely rare, though a perfect example of Pott's disease with psoas abscess is demonstrated here , syphilis and rickets were unknown , osteo-arthritis was very common   In hieroglyphic writing the determinative' for old age is the picture of a man deformed by chronic arthritis

A good discussion of consanguineous marriages is given, and the following conclusions among others are drawn   " The children from these incestuous marriages displayed no lack of mental energy   Both men and women were equally strong, capable, intelligent, and wicked   Certain pathological characteristics doubtless run through the family   Gout and obesity weighed heavily on the Ptolemies, but the tendency to obesity existed before consanguineous unions had taken place   The male and female effigies on coins are those of very stout well nourished persons   The theory that the offspring of incestuous marriages are short-lived receives no confirmation from the history of the Ptolemies "

Certain ascriptions of portraits are, we think, erroneous   Plate LXIV, Fig 4, represents not Thutmose I, but Thutmose IV   Plate LXI , Fig 9, represents not Thutmose IV, but Thutmose I or II

The book is a delight to possess and to read   The criticisms are not intended to detract from its value, but are those which Ruffer himself would probably have made if he had been able to bring his knowledge abreast of the times   The publication has been admirably done   and the illustrations are excellent

Manual of Operative Surgery   By John Fairbairn Binnie, A M , C M , F A C S   Eighth edition revised and enlarged   2 vols   Royal 8vo   Pp xva – 1311, with 1628 illustrations some of which are coloured   1921   London   H K Lewis & Co Ltd   £3 3s net

This book is an old friend   In a few years it has reached in eighth edition , and so rapid have been the changes in the art of surgery during this time that a great many additions, deletions and revisions have been necessary   But old friends must be submitted to judgement, and their faults disclosed   This book has many faults, and in each succeeding edition they grow more numerous There is much to be said in extenuation of its errors   New editions have been demanded so rapidly that the author has found it impossible to keep pace with them   He would have been wiser to have postponed the new edition until he was able to make it worthy of the reputation of the earlier volumes

Only a few of the more serious faults, of which unhappily there are many, can be mentioned here   In the section dealing with the Gasserian ganglion, only brief reference is made to Frazier s work, none to Harvey Cushing's wonderful record of successful cases, nor to the method of approach to the ganglion which he first described , and the name of Adson is not mentioned

The 'scissors and paste' method of the book is flagrantly exemplified in the discussion of the operations for cancer of the tongue   " Only a few of them ", we are told   " will be described " and we read the accounts of eleven   No attempt is made to discriminate between the several procedures, and no advice is given as to which operation is appropriate in certain conditions and inadmissible or disastrous in others   But n's operation is described at great length, and Crile's operation upon the glands is dismissed in a few lines   Kocher's operation, which in later years its author rarely, if ever, performed, is still described, despite the fact that Syme's operation was greatly preferred by Kocher himself

The chapter on gastric surgery is lagging behind the times   The operation of gastroplication is described and illustrated   Who, nowadays, performs it ?   Mayo Robson is quoted from an article twenty years old as advocating gastrolysis, and the author says,   The mere breaking down of gastric adhesions often suffices to cure apparently inveterate cases of dyspepsia "   The illustration   exposure of the beginning of the jejunum " is ridiculous   It is strange that an American author should borrow the trivial and antiquated sketches from Monod and Vanvert s book, when the artists of his own country are unsurpassed

The operation of cholecystectomy is briefly described   Moynihan s method of removal from the cystic duct towards the fundus is discussed , but no mention is made of a danger to which he first drew attention, namely   the removal of a part of the common or hepatic duct when the sigmoid turn of the gall bladder is adherent to the common duct , no indications are given as to the conditions which may occasionally make a removal from the fundus towards the cystic duct a better procedure   The operation of suprapubic prostatectomy is treated very summarily   The description of the operation is inadequate for the inexperienced surgeon, and offers no help or guidance to the surgeon who is no longer a novice   A great number of really important points are neglected, chief among them being the question of post operative stricture

Dr Binnie is, we see   a graduate in Arts of Aberdeen University   He should therefore have a regard for the purity and rhythm and majesty of the English language, and he should use it with that right sense of sound and feeling that every Scotsman inherits   He is often slipshod and careless   and the cacophony of many sentences is disturbing

The references given to original sources are too few   Codman s bursitis is described, and its surgical treatment briefly mentioned   No reference is given to any publication by this author

A lack of such aids to our search in the literature is one of the greatest annoyances to any reader

This book is one of real value, but of a steadily depreciating value   The author will, we most sincerely hope, take greater pains with the next edition   A far more scrupulous choice in the operations to be described is necessary, better illustrations should be prepared for almost every section, references in the text or at the end of the volume, or both, should be given, and the advice of Syme that an effort should always be made to reduce the size of every succeeding edition of a book may with advantage be remembered   Brevity is the soul of more than wit

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Clinical Surgical Diagnosis   By Professor F DE QUERVAIN, Berne University   Third English edition, translated from the seventh edition by J SNOWMAN MD   Royal 8vo   With 731 illustrations and 7 plates   1921   London   John Bale, Sons & Danielsson Ltd   50s net

A BRIEF review of this work will suffice   It is one which can be most confidently recommended to students and practitioners, for it is unrivalled   No book on surgical diagnosis equals it in fullness, accuracy and insight   The discussions are admirable, the clinical acumen penetrating and sagacious and the illustrations are excellent   It is rather a large book, and its price, though not high for the vast amount of material it contains, is considerable for students of to-day   The volume should be in the hands of every student, and a reduction of its price, if possible, would probably help to bring about this result

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Keen's Surgery its Principles and Practice   By Various Authors   Supplementary volumes VII and VIII   Edited by W W KEEN, MD, LL D, Hon F R C S Eng and Edin   Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia   Large 8vo   Pp 1800, with 996 illustrations and separate desk index   1921   Philadelphia and London   W B Saunders Co   Per set   Cloth, £6 6s, Half Morocco £7 15s

IN his preface to these volumes Professor Keen says   ' The first six volumes of this work recorded the progress of surgery down to 1913   Then came the Great War and its remarkable contributions both to the science and the art of surgery   Without a record of that enormous progress this work would have been a torso "   It is almost ungracious to disagree with so great an authority and so charming a personality, but it is an open question whether the results obtained in the war justify the immense amount of work and lavish expenditure of space here devoted to them   To our mind there is in such extravagance even a danger of darkening counsel and obscuring first principles   To those who went through the surgery of the war with open minds the chief impression must always be gratitude that so little that was new and nothing that was revolutionary, did arise   The more experience grew, the clearer it became that the great primary principles of surgery held true in war as in peace and that all that differed in the two cases was the method of adapting the means to the end   As the Editor truly says, " Pasteur and Lister were triumphantly vindicated '   This being so, surely it were well to relegate to its proper peace-time limits the surgery of the Great War, already it is becoming abundantly evident how small a part its lessons are destined to play in the surgery of civil life   Careful perusal of these two volumes leads strongly to the opinion that the work would have gained greatly had the war sections been eliminated and relegated to a separate work

For many years Keen's Surgery has been a classic work   It numbers on its staff no less than 129 contributors—a formidable team for one of even Professor Keen's well known quality to control   The advantage of such a work is this is that each subject is dealt with by the writer who is best qualified to do so   Its disadvantages are in inevitable difference of opinion in over lapping questions and the impossibility of rewriting so gigantic a work every decade or so in order to keep it fully up to date   Therefore the volumes before us have been issued to supplement by their new knowledge the information contained in the previous six   We cannot say that this method makes for clarity   To read the original article written many years ago and then to supplement it by the addition written yesterday is hardly ideal, but is perhaps the best that can be done under the circumstances

Two typical examples of the evils of entrusting the writing of a modern surgery to a large number of specialists' that is so popular now adays, are to be found in the chapters devoted to gas gangrene and affections of the thyroid respectively   Gas gangrene is dealt with to some extent and quite clearly by Professor Adami in chapter 1 (Inflammation ')   In chapter 6 (Gas Gangrene)   Sir Cuthbert Wallace gives an excellent account of the affection to which a good bibliography is appended   Nevertheless the same subject is again treated by Captain Beebe in chapter 12 (' Bacteriology of War Wounds), by Gibson in chapter 15 (' Surgical Technic) by Blake in chapter 17 (Gunshot Fractures ') and by Binnie in chapter 25 (Surgery of Muscles)   One single chapter would have been ample and far less mystifying to the reader   Similarly, affections of the thyroid are brought in by Vinson in chapter 26 (The Food and System of Glands) by C H Mayo in chapter 27 (Surgery of the Thyroid) by Wilson in

chapter 28 ("Recent Advances in our Knowledge of the Pathology of Goitre"), and by Kendall in chapter 29 ("The Chemical Nature of the Thyroid Secretion") A much more clean cut view of the position to day could be given within the limits of a single chapter

But these are defects inherent in the system In the volumes themselves—particularly Vol VIII—there is much of interest and value Adson's chapter on the surgery of the hypophysis is excellent, if somewhat optimistic, and too much confined to the merits of the intracranial route

The surgery of the head is brought up to date by Neuhof The best portion of this deals with Cushing s classic work Much space is devoted to the highly theoretical work of Dandy on hydrocephalus

Frazier deals with the surgery of the fifth nerve He describes his operation upon the sensory root of the Gasserian ganglion, and his clear practical details give an added value to his description His chapter on tumours of the Gasserian ganglion is also excellent The chapter on the technique of bone grafting by Warbasse is disappointing It is wanting in precise details, and the indications for dealing with septic cavities in bone—one of the most important and difficult of procedures—is particularly unsatisfying There is an excellent account of the surgery of the face and jaws, including Esser's 'epithelial inlay method Direct laryngoscopy, bronchoscopy and œsophagoscopy is in the hands of Chevalier Jackson and is excellently done Heuer gives a full discussion of the difficult subject of wounds of the chest Denver and Pfeiffer give a good description of difficult cases of appendicitis A fuller discussion of when not to remove the appendix would be acceptable W J Mayo and D C Balfour give some useful additional points on the treatment of cholecystitis, and also various reconstructive methods for the bile ducts Pearce and Austin write an excellent account of the relative values of the various tests for renal efficiency, and their article also contains a comprehensive dissertation on acidosis

The volumes are worthy companions of their predecessors, and will stand for many years is a monument to their authors and their Editor We congratulate Professor Keen very heartily on a worthy completion of a great task

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On Modern Methods of Treating Fractures By Ernest W Hey Groves, M S , M D , B Sc (Lond), F R C S (Eng), Surgeon to the Bristol General Hospital Second edition Large 8vo Pp 435 with 296 illustrations 1921 Bristol John Wright & Sons Ltd 30s net

Since the first edition of this work, published in 1916 the vast amount of material produced by the Great War has provided ample opportunity for the further study of the treatment of fractures Advantage of this glut of material has been taken, and the author has brought the book thoroughly up to date The second edition has been largely rewritten, and is now a volume of some 435 pages with 296 illustrations There are thirteen chapters, each of which is beautifully illustrated with drawings of specimens and excellent reproductions of x ray photographs The introductory chapter compares the teaching of yesterday with that of to day, and amongst other points great stress is laid on the danger and futility of prolonged fixation in the treatment of fractures, resulting too often in mal union or non union ankylosed joints and wasted limbs The importance of the taking of x ray pictures at once in every case of suspected fracture is pointed out, also the danger arising from delay in taking this precaution until some obvious disability has shown itself A good anatomical result usually means a good functional result , in some cases, however, of good anatomical result the functional result is bad But restoration of anatomical structure is only the beginning of the treatment of fractures, and massage mobilization, and active movements take an almost equally important place in their modern treatment To obtain the best results three things are necessary the will of the patient, sufficiently perfect restoration of the form of the bone to allow of perfect joint action and the preservation of the full vitality of the circulation and the neuromuscular apparatus Co operation between the systems, massage, extension, and operation are essential

Massage as advocated by the author is very different from that frequently understood by the average practitioner The correct method of its application is not a daily rubbing, punching or pummelling of the limb, but a gentle superficial stroking—a soothing caress to the injured part – from the very onset Thus, when properly performed, never causes pain , on the contrary it relieves it, and as it were, lulls the part to sleep, thus relieving ill muscular spasm This form of massage is applicable to every fracture from the time of the accident, and in some is the only treatment required We do not think that the gentle superficial stroking has yet received the notice that it deserves, and too often a fracture is left in splints until union is becoming advanced before massage is advised By this time muscles have wasted, tendons are becoming fixed, and circulation is poor Gentle massage from the beginning is the keynote to success

The treatment by extension is fully dealt with It is pointed out that when applying extension by means of plaster the latter should be applied to a height on the limb well above the site of fracture thus pulling downwards a tube of soft parts as well is the lower fragment The application of plaster up to the site of fracture, as is not infrequently seen, is wrong, is it only pulls on the lower ends of the muscles and does not overcome the resistance of the elastic retraction of the skin and fascia Transfixion pins stirrups, callipers, and traction clamps with their methods of application are described We fail to find however any mention of traction in fractured femurs by

pulling from screws inserted into the tibial crest just below the tubercle This method has undoubtedly proved to be most efficient

In the chapter on experimental observations on operative treatment, large numbers of experiments on animals are described in detail, with excellent diagrams, x-ray pictures and microphotographs The author's experiments go to support Macewen's view that callus is formed from the bone and not from periosteum Specimens are illustrated showing the formation of new bone by means of ossification of cartilage cells, and this can be seen to be taking place from the bone outwards towards the periosteum and not in the reverse direction

The author insists on the utmost care being exercised to avoid any possibility of septic infection Many cases of sepsis occur, not as a result of infection at the time of operation, but because of insecure fixation and the use of foreign bodies which become loose in the tissues If the bones are securely fixed together with no possibility of the uniting medium becoming loose, healing will take place and no sepsis will occur The secure fixation of the fragments is one of the most important factors in obtaining aseptic healing He does not agree that the gloved fingers should not be introduced into the wound , practice and the use of efficient instruments has reduced the possibility of tearing the gloves to a minimum, and the advantages of the use of the gloved hand at certain stages of the operation cannot be overestimated Many methods of fixation are described—intramedullary pegs, plates, screws, plate clips, and wires—annealed iron wire being preferred to the silver wire commonly in use

Nearly one hundred pages are devoted to experimental observations on bone grafting and bone grafting operations for fractures, much of which constituted the author's Jacksonian Lecture on the subject Short accounts are given of the work of Ollier, Barth, Axhausen, and Macewen and the author reconstructs in account of the growth of bone from the work of these authors He comes to the conclusion that the ideal graft is a piece of living bone used in its entire thickness that cortical grafts are better than intramedullary, and that firm fixation of the graft by metal sutures is essential to success , catgut does not give sufficient firmness If there is any doubt as to the asepticity of a healed compound fracture requiring bone-grafting, the two stage operation is advocated rather than waiting for autosterilization

Three chapters are devoted to the treatment of fractures of the upper and lower limbs—splints and retentive apparatus are described, together with details of the operative treatment, and bone grafting of each important bone Thomas's swivel arm splint for fractured humerus is not advocated except for transport purposes, as stiff elbows and delayed union have occurred after its use The advantages and disadvantages of the Thomas knee-splint for fractured femur are discussed

We find no reference to the Sinclair net bed for the treatment of compound fractures of the upper end of the femur This bed has proved to be most efficient in these cases, especially when associated with large wounds of the buttocks requiring frequent dressing

Short accounts of excision of wounds, and treatment by means of B I P P , flavine, and Carrel-Dakin solution are given in the chapter on compound fractures Stress is laid on the importance of not removing any fragments of bone which have any vascular connections The operative fixation of septic open fractures is rightly condemned

The book is one of the best we have read on the subject The author has done an enormous amount of experimental work, the results of which he has described clearly and concisely The conclusions he has come to are definitely stated, and the work will prove itself invaluable not only to operating surgeons but to all who are interested in this, until recently, somewhat neglected subject It is a book that every practitioner should possess

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Manual of Surgery By Alexis Thomson, F R C S , Professor of Surgery University of Edinburgh Surgeon to the Royal Infirmary, Edinburgh and Alexander Miles, F R C S Surgeon to the Royal Infirmary Edinburgh Sixth edition In three volumes Vol I *General Surgery* pp 565 figs 169 Vol II, *Extremities, Head and Neck* pp 659, figs 288 Vol III *Thorax and Abdomen*, pp 566, figs 161 1921 London Henry Frowde and Hodder & Stoughton Vol III 12s 6d net

This text book of surgery representing the Edinburgh school is so well known as to require little general description It is the first edition published since the war and the surgical lessons of the campaigns are among the new material scattered throughout its pages , but only such of these principles are referred to as are of importance in dealing with the injuries of civil life The illustrations which exceed 600 in number are one of the great features of the book They are so good as to form a positive lure to a reading of the text Possibly there is rather too large a proportion of rare and exceptional cases figured where as a greater number of pictures and diagrams of typical conditions might be more useful to the student A good up to date account of current surgical teaching is given with a judicious tendency to non committal in regard to extreme views Thus the various conditions associated with intestinal stasis and mobility of the abdominal viscera are well described and illustrated but the uncertainty of theories and the insufficiency of evidence as regards practical treatment are clearly indicated

The details of operative surgery are not mentioned as these are dealt with in another manual of the same series

We are quite sure that the present edition will greatly increase the popularity of this work

A Guide to Diseases of the Nose and Throat, and their Treatment By CHARLES A PARKER
F R C S and LIONEL COLLEDGE, F R C S Throat Hospital, Golden Square   Second edition
Demy 8vo   Pp xv + 583 illustrated   1921   London   Edward Arnold & Co   25s net

In publishing a second edition of his well known work Mr Parker has been fortunate in securing
the collaboration of Mr Colledge, and they may be congratulated upon the result

Chapter 1 is concerned with the examination of t e upper respiratory tract, it is clear
concise, eminently practical, and well illustrated   *Fig* 14 is open to criticism as a representation
of the normal nasopharynx,' and the method for indirect examination of the lower end of the
trachea is insufficiently described   In many instances this region can only be seen in the mirror if
the patient stands and leans well forward while the surgeon kneels or stoops *much* below the level
of the patient's glottis

Chapter 2 deals with methods of local treatment and a useful list of formulæ is given   We
suggest that these might better be included with the affections for which they are used, thus
rendering the whole subject more intimate and interesting

Operative treatment is described in chapter 3, which contains much useful and practical
information   We note that novocain is not mentioned under ' ocal anæsthesia ', and we fail to
understand why for general anæsthesia " it is advisable to start with gas or C E and give a final
dose of pure ether " It is widely agreed that C E is by no means a safe mixture, therefore why not
charge up the patient with a stimulating anæsthetic like pure ether (open method) and then follow
with just enough chloroform (a depressant) to keep the patient 'under' during the actual operation ?
The authors stress the fact that laryngotomy should not be performed in infants and only as a
temporary expedient in adults   How many intractable cases of stenosis of the larynx and the upper
portion of the trachea would have been avoided if this warning had been heeded !

The technique of the operations for laryngotomy, tracheotomy, intubation and laryngostomy
are well described, and the indications for and against these measures are obviously the result of
personal experience   An excellent resume of diathermy concludes the chapter

In chapter 5 we have an excellent description of tuberculosis of the upper air-passages and
their treatment, but we doubt if all surgeons would agree that the external operation for retro
pharyngeal abscess is always to be preferred to the internal or transoral method   The latter
method is frequently employed for abscesses due to pyogenic infection and the external operation
is reserved for tuberculous cases   The results justify this discrimination

Chapter 7,   Complications Occurring in Organic and Chronic Constitutional Disorders
should be read and re read by all who contemplate specializing in diseases of the throat and nose
The authors prove to the hilt how necessary it is that the true specialist should be one who has
previously acquired a sound practical knowledge of general medicine

Section III is devoted to wiseases of the nose, and those chapters which are confined to the
acute and chronic inflammatory affections give a concise and well balanced account of their
present day treatment   The chapter on the diseases of the accessory sinuses reflects
current views and treatment   We note that no mention is made of pain in the ear is a symptom
of sphenoidal sinus suppuration, nor is reference made to the possibility of that intractable and
frequent complication of the Caldwell Luc operation for chronic maxillary antral suppuration
viz, the formation of an unpleasant smelling, shell-like crust of dried discharge which has to be
expelled every four or five days   It should be emphasized that this trouble is most likely to occur
when the whole mucosa of the sinus is removed and its place taken by granulation tissue   Further
more, it should be pointed out that epiphora from cicatricial stenosis of the lower end of the
lachrymal duct has not infrequently followed the Denker operation   Many cases of aspergillosis
of the antium have been recorded, but the affection seems to have been overlooked by the authors

In describing the exploration and treatment of the frontal sinus (p   271), the common
mistake is again made of using the terms infundibulum and 'front nasal canal is if they were
identical—the infundibulum is a groove or gutter formed internally by the uncinate process and
externally by the bulla ethmoidalis', while the frontonasal canal lies above it and is a quite
independent structure even though it may be continuous with the infundibulum   The authors
rightly condemn external operation on the frontal sinus is a routine procedure and advise it only
when other internasal measures have failed and local or general symptoms indicate the more serious
and complicated operation

The chapter on the reflex nasal neuroses, e g   asthma, paroxysmal rhinorrhœa, hay fever
etc, is excellent   The anaphylactic origin of these conditions is clearly stated, and it may be
hoped that one result of such knowledge will be to decrease the number of unnecessary nasal
operations which have been performed in past years

In a later edition the authors will no doubt give greater prominence to the treatment of
malignant disease of the nose by radium and the recently introduced Erlangen x ray method

In diseases of the nasopharynx adenoids naturally take first place, and a full description
of symptoms diagnosis and treatment is given   In the latter it would have been well to lay some
stress on a thorough removal of the lymphoid tissue in Rosenmuller's fossa, because experience
imply proves that aural symptoms may continue or develop later on when this detail has
been neglected and often in those very cases where an imposing but centrally situated mass of
vegetation has been removed

We do not think that many rhinologists will agree with the authors advice that when a

fibroma is chiefly confined to the nasopharynx, it should be removed through the mouth after splitting the soft palate" a better route is by way of the nasal cavity. In endothelioma of the nasopharynx no mention is made of the very characteristic early symptom viz, unilateral deafness and the accumulation of mucus in the tympanum, together with anæsthesia of the second division of the fifth nerve and mechanical weakness of the levator palati muscle—a triad of symptoms which are pathognomonic of the disease

The operative treatment of diseased tonsils is well described, but we maintain that there is only one satisfactory method of dealing with serious post operative hæmorrhage, viz, to find the bleeding vessel and ligature it rather than to apply any form of compression clamp or to suture the pillars of the fauces over a "roll of ribbon gauze. To insert Michel's clips through the pillars is scarcely in accord with surgical principles

The chapter dealing with the surgical treatment of malignant growths of the pharynx is of great value to all who are interested in this subject, and the illustrations are excellent

Diseases of the œsophagus and of the larynx are described in a clear and exhaustive manner In the treatment of papillomata of the larynx no reference is made to the value of the intra-laryngeal application of radium—probably the most efficient method of treating this troublesome affection

Not only the 'post-graduate student', but the specialist also will find pleasure and profit in this excellent volume

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The Submucous Resection of the Nasal Septum By W MILDDAUCH DUNNING M D (N Y)
Crown 8vo Pp 97, illustrated 1921 New York Surgery Publishing Co

IN this little volume the author lays stress on the importance of normal nasal respiration, and points out that this is most frequently interfered with by irregularities of the septum He describes the usual forms which such obstructions may take they are well illustrated, and the operative technique for their removal is clearly described, and based on sound surgical principles

Chapter 1 deals with the normal anatomy of the nose and the nasal fossæ, but we would suggest that on pp 9 and 14 considerable ambiguity is introduced by using the words 'vibrissæ' and cilia as indicating correlative structures Nor do we agree "that the greater part of the septal circulation comes from above", i e, the nasal branch of the ophthalmic artery Surely it is derived from the artery of the septum'—a contention which would be acquiesced in by any surgeon who has had to deal with many cases of epistaxis or post-operative nasal hæmorrhage

Dr Dunning would seem to adhere to the 'reflex' origin of asthma in regard to nasal obstruction of septal origin whereas most rhinologists would incline to the view that asthma is a symptom of anaphylaxis, and when the removal of a septal obstruction is followed by the relief or cure of the bronchial spasm, the result is brought about by the withdrawal of the specific protein to which the patient is peculiarly sensitive This protein is often of bacterial origin, and its disappearance coincides with the more efficient drainage and aeration of the nasal cavities The technique of submucous resection is practised by the author does not reveal anything new to us and while rightly pointing out the possible dangers of cocaine as a local anæsthetic, he does not mention that very valuable and non-toxic analgesic, novocain Furthermore, if a preliminary hypodermic injection of morphia and atropine be given, there will be need for less local anæsthesia of any kind

We do not think sufficient stress is laid on the chief causes of failure of submucous resection in relieving the nasal obstruction Two at least should have been emphasized (1) The removal of the premaxillary process at the posterior, internal, and lower portion of the vestibule (2) The anterior end of the inferior turbinal in the concave aspect of the deviation

Such practical details might well take the place of chapter 5, Special Surgical Procedures because, in the author's own phrase the manipulations are hard to translate from action to words'

We entirely agree with the statement that only in extreme cases of obstruction should septal operations be performed in young children

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Intrinsic Cancer of the Larynx and the Operation of Laryngofissure By IRWIN MOORE M D C M, I dm Surgeon to the Hospital for Diseases of the Throat Golden Square W Royal 8vo Pp xii – 147 1921 University of London Press 20s net

THIS monograph is a re-issue in amplified form of a series of articles originally published in the *Journal of Laryngology Rhinology and Otology* in 1918 It is a work of thorough and conscientious detail, and there can be no doubt it was well worth being made available in its present convenient form Though the frequency classification and diagnosis of laryngeal cancer are discussed the chief interest of the book lies in the very full history it gives of the operation of laryngofissure and the minutely detailed description of the technique of this procedure

Dr Irwin Moore gives due prominence to the fact that although Arthur Durham had established the usefulness of the operation as early as 1872 a period of 18 years was to elapse before the work of Butlin and Semon began to make current what is now recognized as the most generally valuable of the methods of treating intrinsic laryngeal cancers There can be few operations with

regard to which professional opinion has passed so completely from authoritative condemnation to universal approbation   In connection with this change of opinion, it is interesting to note that the replacement of laryngectomy by laryngofissure involves an important advance of principle Laryngofissure ensures adequate exposure and definition of the disease before its removal is begun and allows the excision to be carried out in exact accord with the needs of the individual case Laryngectomy on the other hand is a formal anatomical procedure, and relatively incapable of exact adjustment to the individual case   There can be no doubt that the precise determination of the situation and extent of the lesion should be a recognized step in all operations designed to deal with malignant disease of the larynx or pharynx

Dr Moore's description of the technique of the operation is exhaustive and precise   That his experience has been thoroughly assimilated is shown by the numerous practical hints he puts before the reader, and the many ingenious instruments he has devised and brought into use   If one might feel inclined to any criticism of this part of the book, it would be on the ground that the conscientious and even meticulous minuteness of the description might give to the inexperienced the impression that the operation is more formidable than in actual practice it is found to be However this may be, the emphasis that is laid upon the need for considerable organization and the mastery of detail is in every way sound and admirable

Although it is not a legitimate criticism it may yet be regretted that Dr Moore has limited himself so strictly to the themes indicated by his title   There can be little doubt that a full discussion of all the means available for the treatment of intrinsic cancer of the larynx is once more becoming necessary   The value of laryngofissure is established beyond all question , but there is perhaps a tendency to regard it as the only really hopeful method available, and to ignore as relatively uninteresting the not very infrequent cases to which it is manifestly inapplicable Surgical feeling will certainly come to regard the dreadful mutilation of total laryngectomy as less and less admissible in treating a form of cancer that in its more favourable types is curable by so benign a measure as laryngofissure   Some form of operation would seem to be needed intermediate in range between these two—capable of more extensive application than laryngofissure without involving the functional disability of laryngectomy   The application of plastic surgery to the reconstitution of the larynx after extensive resections is already plainly indicated is the direction in which the solution of the problem is to be found

It would have been of value to learn Dr Moore's views as to the treatment of those cases that are excluded from the range of laryngofissure, such, for example, as cases of very extensive local disease, of recurrence after laryngofissure, and of precocious involvement of the cartilage   These are undoubtedly of very special, perhaps even of predominant interest, as they involve problems yet unsolved

The fact that gives to intrinsic laryngeal cancer a great part of its special interest to the surgeon is its relative benignity—a character very well shown in the various series of results quoted by Dr Moore   He accepts without question the current view that this comparatively benign quality has a purely anatomical explanation and depends on the isolation of the cancer within the resistant cartilaginous box of the larynx and the sparseness of the lymphatic channels leading from it   This view leaves unexplained the occasional occurrence of extremely malignant cancers within the larynx and is far from unobjectionable on general grounds

Some of these ultra malignant growths, although they may present clinically, and even it operation, all the appearances of the intrinsic cancers, are in fact of pharyngeal origin and start in the deepest part of the pyriform sinus   It seems not to be at all generally known that a growth originating here may fail to make any appearance in the pharynx at all, but may at a very early stage penetrate the lateral wall of the larynx on the one hand and the thyroid ala on the other Such tumours provide an almost impossible task for the diagnostician , we should have specially welcomed some discussion of them by Dr Moore, is they are absolutely unsuited for treatment by laryngofissure, and constitute one of the very worst conditions the surgeon can meet with in that operation

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The Venereal Clinic   A Handbook of Venereal Disease in Relation to the Individual and the Community   By Several Writers   Edited by ERNEST R L CLARKSON, M A M R C S   With an Introduction by Sir SQUIRE SPRIGGE   Demy 8vo   Pp xiii + 477, with 20 plates some in colour   1922   London   John Bale, Sons & Daniel son Ltd   25s net

This work is a collection of monographs by specialists actively engaged in the treatment of venereal diseases for the instruction of students and practitioners and the authors have aimed to convey as concisely as possible such information as will enable anyone to manage safely the majority of cases dealt with in a V D clinic   The result is a work which should prove of great practical value to those for whom it is intended

The book is divided into two portions—medical, dealing with diagnosis and treatment, and sociological   The syphilis section of the medical portion has been written by Dr Malcolm Simpson and Dr H C Semon, with a preface by Dr Sequeira, and describes mainly the practice of the London Hospital   A good feature is the differential diagnosis of secondary and tertiary skin lesions, always troublesome to the inexperienced   In a small work it is notoriously difficult to select the points to emphasize and those to pass lightly over, but we should have thought the diagnosis of syphilis of the mouth region from carcinoma worthy of note   The treatment, which is outlined in the second portion of this article, shows a faith in the power of a few doses of '914

or galyl, and of mercury, to cure an early case of syphilis, and a trust in the Wassermann test as a guide to cure which we confess we do not altogether share   For a primary case in an adult male the treatment is 0 6, 0 9, 0 9, 0 9 grm '914' at weekly intervals, and eight weekly injections of mercury (or two months' pills), after which no further treatment is given unless the Wassermann reaction becomes positive   A secondary case receives the same initial course, and this is repeated after two months, when treatment is suspended, unless two months later or on a subsequent test the blood reaction is found to be positive

If we could only know how much injury to the parasite of syphilis was indicated by a negative Wassermann reaction, we should be saved much uncertainty of thought regarding the progress of our patients   Our positive knowledge, however, is that many cases relapse from negative to positive many months after treatment has been stopped   we often discover the positive reaction only when the patient returns with clinical symptoms, having defaulted from the clinic in the meantime, and in such cases we may have the opportunity of learning that our patient, whose Wassermann reaction was negative the last time we saw him, has defeated the aim of the V D scheme by adding at least one other to the syphilitic population   Such experiences as these make us wish that—since we cannot keep our patients from sexual intercourse by force, or compel them to attend at regular intervals, or get out of their heads that negative blood means cure (particularly if we show ourselves to be so greatly guided by it)—those who treat syphilis would make a little more sure of eradicating the disease before stopping treatment, even if a few were over-treated in the process

The section on gonorrhœa in the male is written by the editor, with a chapter on the urethro scope by Mr Wyndham Powell   Both articles are thoroughly practical and, if the lessons which they convey are well learnt, we can hope to see less of the transmission of gonorrhœa to innocent partners, for which many practitioners cannot be held altogether blameless   The general public will continue to regard lightly and to transmit the disease until the medical profession, impressed itself by such teaching as Dr Clarkson's and Mr Powell's, tells it with one voice that cure is a difficult matter to determine and that sexual intercourse before cure is a social crime

The reader of many works on gonorrhœa may be confused by the difference in practice of various clinics in regard to irrigation   In one book he reads that weak solutions should be used and in this work he is advised to employ concentrations which the first book told him were too strong   One author tells him to employ posterior irrigation as soon as he can persuade the sphincter to open, this work gives him the impression that posterior irrigation is no light matter, and not to be undertaken without clear indications   We think that, in regard to the last mentioned divergence of opinion, a reconciliation might be found in the first, viz, the concentration of the solution, since it is probable that irrigation with a strong solution really is a serious matter

Dr M Rawlins' article on gonorrhœa in women contains many valuable hints on a subject which is much neglected   Some remarks on tests of cure would be useful in a future edition   Mr Roxburgh deals with gonococcal eye infections, and Dr Panton with the bacteriology of V D

The section on the sociological and administrative side of venereal diseases contains a large amount of useful information not easily to be found elsewhere   It includes an exposition of the two opposing views on the question of prophylaxis by disinfection and some remarks on the principles which the editor thinks should govern the general management of the V D problem

There are five appendices—on the organization of V D clinics, syphilis and gonorrhœa sections, a specimen leaflet in relation to immediate self-disinfection, on the making of dilutions from concentrated solutions, on the restriction of 'prostitution', and a general bibliography

Altogether, the editor and his colleagues are to be congratulated on having produced in such convenient compass a work which is full of practical information

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A Pocket Surgery By Duncan Fitzwilliams, C M G, F R C S (Ed), Surgeon in Charge of Out patients and Lecturer in Clinical and Operative Surgery, St Mary's Hospital, London   Crown 8vo   Pp 348   1921   London   Edward Arnold & Co   10s 6d net

This is an attempt to confine within a very small compass the whole range of examination surgery   In this endeavour the author has been very successful   Every essential of surgery is summarized briefly and accurately, and, provided that a student has read a larger book carefully and done his clinical work well, this pocket book should be of great use to him as a key to the cupboard in his brain

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Handbook for the Limbless   Edited by G Howson, formerly Officer in Charge of the Curative Workshops, Special Surgical Hospital Shepherd's Bush   With a Foreword by John Galsworthy   Pp 225   1921   Published by the Disabled Society 48, Grosvenor Square London, W   1s net

This little book, in the production of which a number of writers have shared, is intended as a guide both to limbless patients and to the medical men who have charge of them   In addition to short descriptions of various patterns of artificial arms and legs, it gives sound advice and suggestions in regard to physical training   occupations and recreations suitable for men who have lost one or more limbs   It concludes with short references to organizations which are prepared to help the limbless in various ways   It ought to be of great service to disabled men and those responsible for their care

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